# HANDBOOK TO THE FISH-HOUSE

IN THE GARDENS OF

# THE ZOOLOGICAL SOCIETY OF LONDON.

BY

E. W. H. HOLDSWORTH, F.L.S., F.Z.S.

ETC. ETC. ETC.



LONDON:

BRADBURY AND EVANS, 11, BOUVERIE STREET,

AND AT THE SOCIETY'S GARDENS IN THE REGENT'S PARK.

MAY. 1860.

LONDON:
BRADBURY AND EVANS, PRINTERS, WHITEFRIARS.

# INTRODUCTION.

This Work is intended as a Handbook of reference to which Visitors may turn for information about the various Fishes and invertebrate animals exhibited in the Fish-house of the Zoological Society of London, and not as a detailed guide to the several tanks as they are arranged. The latter plan would involve a disjointed history of the collection, as well as much needless repetition. Many curious animals are frequently transmitted to the Gardens, but have too often suffered so much on their journey, as to be unable to survive under the unnatural conditions, which, to a certain extent, must exist in the best managed Aquaria. It has, therefore, been considered desirable to give a short notice of all the species which have ever been received, as there is no reason to doubt that any of the curious forms of animal life which from time to time have been exhibited, may again come into the Society's possession. Coloured sketches, with the names of the principal animals, are affixed to the different tanks, and by referring to the Index at the end of this book, the visitor will ascertain the page at which their habits are described.

E. W. H. H.

# CONTENTS.

# HANDBOOK

TO THE

# FISH-HOUSE.

## I.—HISTORY OF THE AQUARIUM.

Before proceeding to describe the contents of the various tanks in the Zoological Society's Fish-house, it may be well to give some historical account of the introduction of Aquaria, and the principles on which animal and vegetable life may be maintained for an indefinite time in unchanged water.

The fact of the evolution of oxygen from plants under certain conditions was first noticed by Priestley towards the end of the last century, and was subsequently confirmed by many curious experiments, described in the works of Ingenhousz, Saussure, Senebier, and others. It was found by Saussure that plants during cloudy weather, or at night, inhaled the oxygen of the surrounding atmosphere, and exhaled carbonic acid if they remained in obscurity. But as soon as they were exposed to the rays of the sun they gave off the oxygen they had previously inhaled in about the same quantity as they received it, and with great rapidity. De Candolle also ascertained by experiment that if a plant was placed in a closed vessel containing a known quantity of carbonic acid, and was subjected to the influence of the sun, "the air indicated an increase of oxygen proportioned to the quantity of carbonic acid which had disappeared, and that the plant had gained a proportionable quantity of carbon. Therefore, the carbonic acid which had disappeared had given its oxygen to the air and its carbon to the plant, and this had been produced solely by the action of solar light."

For a long period it was believed that plants absorbed during the night the same quantity of oxygen as they had evolved in the day, so that, in the end, the oxygen contained in the air was not actually increased. Dr. Daubeny, however, has proved that this is not the case; but that plants do really exercise a purifying influence on the atmosphere, and whilst they continue healthy the oxygen produced by them goes on increasing, the diminution by night being more than

counterbalanced by the gain during the day. In 1833 he communicated to the British Association some observations on the action of light upon plants, and that of plants on the atmosphere. The result of his experiments induced him to believe that the decomposition of carbonic acid, by which oxygen was liberated, was caused by the illuminating power only of solar light, and that the heating and chemical properties of the rays were not concerned in the process. "He regarded light as operating upon the green parts of plants as a specific stimulus, calling into action, and keeping alive those functions from which the assimilation of carbon and the evolution of oxygen result;" and, "considering the quantity of oxygen generated by a very small portion of a tree or shrub, he saw no reasons to doubt that the influence of the vegetable might serve as a complete compensation for that of the animal kingdom."

The subject was again brought before the British Association in 1837 by Mr. Ward, who communicated a paper *On the growth of Plants in Closed Cases*, and at its conclusion directed the attention of the members to the development of animal life on the same principles.

The first account we meet with of the actual establishment of an aquarium occurs in Dr. Johnston's *History of British Sponges and Lithophytes*, published in 1842; but in this case the experiment was made, not so much with the view of establishing the balance of animal and vegetable life, as of testing the vegetable nature of *Corallina officinalis*, the beautiful jointed seaweed so commonly seen fringing the sides of our rock-pools. A tuft of this weed with several little mussels and annelides and a starfish was placed in a small jar of pure sea-water, and at the end of eight weeks the *Corallina* was still growing, and many of the animals were alive and active in the unchanged water. This result was conclusive of the nature of the *corallina;* for if it had not been a vegetable the oxygen in the water would not have been renewed, and the animals must have died after a few days' immersion. It was not, however, until 1850 that the idea was properly carried out of "adjusting the relations between the animal and vegetable kingdoms by which the vital funotions of both should be permanently maintained." On the 4th of March in that year a paper was communicated to the Chemical Society by Mr. Warington, in which he described the results of an experiment he had been prosecuting for some months with two Gold-fish and a plant of *Valisneria spiralis*. This trial of a fresh water aquarium promised to be satisfactory: but, after a time, the exuberant growth of *conferva* on the sides of the vessel, and the accumulation of decaying vegetable matter from the cast-off leaves of the plant, showed there was still something wanting to ensure success. The introduction of a few water-snails (*Limnea stagnalis*) was found to supply this need, so that by their rapid removal of the superfluous vegetable matter the water was restored to its original purity, and the permanent establishment of the aquarium secured.

In the *Gardener's Botanical Magazine*, published in January, 1852, we find another communication from Mr. Warington, in which he states that he was at that time "attempting the same kind

of arrangement with a confined portion of sea-water, employing some of the green seaweeds for the vegetable member of the circle, and the common periwinkle as the representative of the water-snail."

The results of these experiments were laid before the Hull meeting of the British Association, and were subsequently published in some of the Natural History magazines.

In the meanwhile Mr. Gosse, unaware of Mr. Warington's attention being directed to the subject, had been engaged in similar experiments, with the object of providing facilities for the study of marine life. An account of these experiments appeared in the *Annals of Natural History*, in October, 1852; and further details of their success were given in *Rambles on the Devonshire Coast*, and in later works by the same author. Thus, by the independent labours of these gentlemen, begun about the same time, the main difficulties attending the establishment of the marine aquarium were overcome, and we are now enabled to study at our leisure the habits of animals whose existence but a few years ago was almost unknown.

---

## II.—PRINCIPLES OF THE AQUARIUM.

As it is desirable that the principle of *compensation* on which the aquarium is maintained should be perfectly understood, some explanation of it will now be given, and certain points noticed in the management of marine tanks upon attention to which their success will materially depend.

The products of animal and vegetable *respiration* first demand attention.

It may be stated as a general rule that *animals absorb oxygen, and exhale or throw off carbonic acid gas; plants on the contrary, absorb carbonic acid, and throw off oxygen.* Animals therefore require what plants reject, and what is necessary for the plant is given off by the animal; so that a continual interchange goes on between the animal and vegetable kingdoms, whether on land or in water: one *compensating* for what it receives by giving up what the other requires.

The principal point then to be attended to in the maintenance of the aquarium is the *balance*, or right proportion of animal and vegetable life, that each may produce a sufficient quantity of the particular kind of gas necessary for the existence of the other; and in considering the properties of these gases, it is important to bear in mind that carbonic acid is a combination of oxygen and carbon, and when decomposed or separated into these two elements, each of them is appropriated to a different purpose.

In the Marine Aquarium (of which we purpose specially to treat), the vegetation must, of course, consist of seaweeds, and in order that their functions may be properly exercised, and their part in the economy of nature performed, it is necessary to subject them to the action of light, which stimulates their respiration, or in other words, causes a rapid decomposition of the carbonic acid separated by them

from the water, and thus sets free a supply of oxygen for the use of the animals they are associated with.

Light then is a necessity, and its proper regulation will be found of the utmost importance in maintaining the aquarium in a satisfactory state.

In endeavouring to establish the conditions of marine life, we must take Nature as our guide as far as possible: so we will first observe what takes place in the sea with regard to the admission of light.

We there find the illumination is entirely from one direction—light is admitted only from above: and in passing through the water, its intensity must be lessened as the depth is increased. This circumstance has an important effect on the distribution of animal and vegetable life, so much so, that if the shore be divided into zones or bands according to the depth of water, or strictly speaking, to the degree of light admitted to it, each division will have its own peculiar plants and animals which flourish within its particular limits, and many of these productions become stunted or die if placed beyond. It is often impossible to provide the necessary conditions in a small tank, for animals found only in the deep sea, and this is one reason why it is so difficult to keep them alive; but although we cannot always secure the proper depth of water, still we may imitate the degree of illumination they are accustomed to, by screening off the light, and this will frequently enable us to preserve them for a long time in health. If, however, the animals are such as naturally live at a considerable depth, and therefore in a state of comparative darkness, a difficulty arises in their management, which is not very easily overcome. In order to secure for them a continuous supply of oxygen, plants become necessary; but most of the sea-weeds found in very deep water are quite unfitted for living in an aquarium, on account of their great size and unsightly appearance; large fronds of *Laminaria* would be quite out of place in a tank, and no efforts to keep these Algæ alive have hitherto succeeded, so that we here fail in one of the essential elements of the balance of life—vegetation. This can only be provided for by artificial aëration, and a larger proportion of water to the number and size of the animals. Success then in the preservation of deep water animals must be considered as exceptional, and with our present knowledge unattainable on the ordinary principle of *compensation*.

Our difficulties, however, vanish as we approach the land; and when within the range of the tides, and we can procure our specimens above or near low water mark, we find animals of various kinds associated with seaweeds of moderate size and surpassing beauty—both living under conditions easily imitated in an aquarium of almost any convenient dimensions.

Marine *Algæ*, or seaweeds, are generally divided by botanists into three sub-classes, according to the colour of their fronds or leaves:

1. *Melanospermeæ*, or Olive-brown weeds.
2. *Rhodospermeæ*, or Red weeds.
3. *Chlorospermeæ*, or Green weeds.

Of these, the Brown seaweeds have perhaps the widest range of habitation, and according to the species, grow in equal abundance close to the surface, and in very deep water. The dark masses of bladdery *Fucus* covering our rocks near high-water mark, and the long ribbon-shaped fronds of *Laminaria*, commonly known as the Tangle, or Oarweed, which gracefully float over the bottom at a depth of several fathoms, are examples of the most prominent forms of this division. They are mostly of considerable length, and elegant as many of them appear as they wave their long streamers in the tide, there is little to recommend them as inhabitants of the aquarium, either on account of individual beauty, or capacity for eliminating oxygen.

The Red weeds are more restricted in their range, and occupy an intermediate tract of shore, extending from about low-water mark, downwards to a considerable depth of water, a great number of them growing parasitically on the stems of the large brown *Laminariæ*. Moderate in size, and with forms and colours of exquisite delicacy, the Red seaweeds are fitting ornaments for the aquarium, and include among their numerous species some of the loveliest examples of marine vegetation. A careful regulation of the light, however, is essential to their existence in a tank; for living as they do naturally at a great depth, or if nearer the surface, growing in some sheltered crevice, overshadowed by projecting rocks or larger weeds, only a small quantity of light can reach them. We must therefore take special care to hide them from the direct rays of the sun, as the only means of keeping them in health, and preserving the rich tints they naturally display. Their use in the aquarium is comparatively little, for their ordinary habitation is too far removed from the light to render them efficient agents in producing oxygen. If exposed to too strong an illumination they fade, and the brilliant red of their fronds gives way to a pale sickly yellow, the sure sign of approaching decay; green confervoid growth—that pest of the aquarium—soon clothes their delicate branches, and in a short time nothing remains but a mere skeleton of the once beautiful plants.

Few things show more plainly than the Red seaweeds the necessity of studying the conditions under which the proposed tenants of the aquarium naturally live. Mr. Warington has proved this by an interesting experiment. He exposed a plant of red weed to the influence of a strong light, and the result was what we have just mentioned; green conferva rapidly sprung up and covered the exposed parts of the red plant. He then diminished the light by the aid of blinds or some other mode of screening the tank, and it was found that as the illumination was lessened, the green weed dwindled away, and its place was taken by a red conferva; light was then again admitted, and the red conferva gave way in turn to a luxuriant growth of green plants.

Here then we have an instance of the direct influence of light on the development of different forms of vegetable life, and according to the same rule, germination takes place in the minute spores or seeds which are scattered in myriads throughout the sea. From these spores are produced the various species of Algæ, those belonging to

any of the three colours being developed according to the degree of illumination, and the presence of other suitable conditions.

The Green seaweeds, of which we have now to speak, are abundantly distributed over those parts of the shore lying between high and low water marks; a few species are found in comparatively deeper water, but by far the greater number flourish in situations laid bare during the recess of the tide; so that when submerged, the quantity of water covering them is not sufficient to prevent their being subjected to the strong influence of the solar rays. They consequently become powerful agents in evolving oxygen, and the supply afforded by them is distributed by the continual motion of the water to those parts where the vegetation is scanty, or less fruitful in the production of this gas.

The brilliant colour of most of the green weeds is in a great measure dependent on this exposure to light, and is intimately connected with their power of rapidly evolving oxygen. In the case of land plants it is well known that darkness prevents the development of their colouring matter, and if kept in this state of obscurity, they soon put on a sickly appearance, and do not give off the usual quantity of oxygen. The same rule applies to green seaweeds, and the effect of continued darkness on those kinds which live habitually exposed to the sun's rays, is even more rapidly fatal than to land plants under similar conditions.

As seaweeds are unprovided with true roots, they cannot extract any nutriment from the ground, but must depend entirely on the surrounding water for their means of subsistence and growth. From this source they derive the various salts found in their tissues, as well as the gases necessary for their respiration. But in order that their functions may be properly performed, the stimulus of light is necessary, which acting on the green plants in a peculiar manner, first converts certain parts of their substance into colouring matter, and then by the agency of this material, decomposes the carbonic acid absorbed from the water; at the same time liberating the oxygen for the use of the animal world, and fixing the carbon for their own increase.

Thus we see that green vegetation is the kind most suitable for the aquarium, as possessing the greatest power of eliminating oxygen. But whilst all the littoral species are useful for this purpose, the most pleasing kinds require some attention to ensure their healthy growth. Nothing is easier than to procure an abundance of green weed in sea water or fresh water, and the greatest precautions that may be taken in purifying the water by filtration, are not sufficient to deprive it of the germs of many kinds of low-organised plants; and if such water is kept still, so that the spores can find a resting place, exposure to light will soon call into existence a strong growth of filamentous weed or *Conferva*.

Such is the character of the green scum covering the exposed surface of stagnant pools, and its rapid development is a beautiful provision of Nature for preserving the purity of the water; for unless there were some means of getting rid of the poisonous gases produced

by decaying matter, the water would become unfitted to support life, and the swarms of minute animals which we find in these pools could not exist. In marine tanks, where the water is also generally motionless, the same rapid growth of other kinds of *Conferva* takes place, and its use is as great as in the fresh-water pools; but its appearance is unsightly, and every exposed part of the tank soon becomes covered with it, to the destruction of more delicate plants, as well as of many of the smaller animals. A *subdued light* will be found sufficient for most of the attractive marine plants, and whilst we are unable without great expense to imitate in our tanks the unceasing movements of the sea, we must exclude the direct rays of the sun, or failure of our aquarium from an excess of the vegetable element will be the consequence. Periwinkles, or other graminivorous mollusca, are sometimes useful in consuming the superabundance of seaweed, but they cannot always be trusted, and the ornamental plants are as frequently devoured by them as those it is desirable to get rid of; moreover, their scavengering operations are not very methodically performed, and half consumed patches of *Conferva* are disagreeable evidences of their fastidious taste.

It is best, then, to restrain the excessive growth of vegetation by a proper regulation of the light, and this can be easily effected by the use of screens or covers to the tank, if the light is only admitted through the surface of the water, as is the case in the sea.

When the principles of the aquarium were first practically studied, it was believed that a large quantity of vegetation was necessary to keep the water sufficiently aërated, but experience has shown that such is by no means the case, and really there is more danger to be apprehended from too much green weed than from a deficiency of it. Most persons who have paid attention to the subject during the last few years, must have been surprised at the small quantity of vegetation that has kept their aquaria in a satisfactory state; and little as has been there required, a still smaller proportion is found in that great natural aquarium—the sea. Other sources of oxygen, however, are there met with, which aid the seaweeds in keeping the water pure, and free from deleterious matters. The ever-changing motion of the sea—by the action of tides, and the force of the wind—is continually bringing fresh particles of water to the surface, and exposing them to the influence of the atmosphere; every ripple on the shore contributes its share to the general aëration; and when the waves dash over the rocks, or roll onward to the beach in long lines of surf, a large quantity of air becomes entangled in the water, and is carried back with it to assist in the purification of the great body of the sea. In the same manner falling rain drives air into the water, and the violent agitation of the ocean when the storm sweeps over its surface, is also a powerful agent in the restoration of its exhausted gases.

These are conditions we can at present only partially imitate in a small tank by the use of the syringe, or some other occasional means of agitation. We must, therefore, seek for the means of maintaining life by the reciprocal action of the plants and animals, always remembering, however, that Nature must be our guide, and the closer we

follow in her steps, and imitate the conditions she requires, the greater success we may expect.

This is a point that cannot be too strongly urged, as it is one to which little attention has been generally given.

In the admission of light, the arrangement of the rockwork, and the distribution of the animals, fancy is too often the presiding genius; and in such cases the sometimes mysterious failure of the aquarium may be frequently traced to the neglect of some well-known natural law.

The main difficulties at present met with in the satisfactory maintenance of the aquarium are unquestionably due to our ordinary inability to imitate that most important condition of the sea—its continual motion. The advantages derived from that movement are incalculably great to its inhabitants; so much so as to mask, in a great measure, the principle of *compensation* on which plants and animals are largely dependent for the supply of the gases necessary for their respiration. In a small tank the presence of decaying animal or vegetable matter, even in inconsiderable quantities, is often sufficient to destroy the purity of the water, and so to cause the death of the animals in it; for the poisonous gas, carburetted hydrogen, arising from putrefaction is there confined within a small space, and the stagnant condition of the water prevents its rapid combination with the oxygen, which, uniting with the hydrogen, produces water, and with the carbon results in carbonic acid. But, in the sea, any dead matter not consumed by crabs or other scavengers is distributed in every direction as fast as it becomes decomposed, and assumes the gaseous form, and a supply of pure water immediately takes its place, so that the plants and animals in the neighbourhood are not exposed to any hurtful influence arising from it, as is the case when the decaying matter gives off its deleterious gases in the motionless water of the aquarium.

In large establishments this movement of the water may be produced without much difficulty by the aid of gutta percha pipes and a small reservoir or supply-tank, from which the water may flow into the aquarium and the waste be pumped back to continue the circulation; for it is not necessary that the water should be renewed. Any loss that may take place by evaporation should be made good by the addition of pure fresh water; but the great bulk of the sea-water will last for years if it is kept well aërated; indeed, there is no reason for its ever being unfit for use. The salts held in solution retain their properties for an indefinite time, as far as is known; and as the pure water is all that is lost by evaporation, that alone requires replenishing in order to preserve the proper specific gravity or density of the whole.

In small tanks the water may be temporarily agitated by the use of a convenient kind of force-pump adopted by Mr. W. Alford Lloyd; but unless there is a special supply-tank placed on a higher level than the aquarium, so as to ensure a continuous stream, the movement of the water cannot be easily maintained. Prawns and fishes are also useful, to a certain extent, in causing a motion of the water, but they have too little power to produce anything like the continued washing of the sea which the *Actiniæ* are accustomed to; for it will

be remembered that these animals, being attached, are exposed to the recoil of the water from the resistance of the rock as well as to the influence of the tidal current; and this double motion of the water produces the wash which gives such a life-like appearance to everything growing within its reach. Animals subjected to this peculiar movement of the sea display a vigour almost unknown in the usually quiet waters of the aquarium. The *Actiniæ* attach themselves firmly in sheltered crevices and expand their flower-like discs to the ever-changing water around them, every wave brings a fresh supply of food within their reach, and their bodies are kept clean by the motion of the water. Fishes, and other swimming animals, also seem to enjoy the continual struggle necessary to prevent their being carried away by the stream, and thus all their vital powers being called into action, everything presents the appearance of health and animation.

Such are the results we must endeavour to produce in the aquarium, and we can only do so effectually by imitating, as far as possible, the means employed by Nature.

In cases where it is inconvenient or difficult to establish a constant change of water, as in small tanks, great advantage may be derived by occasionally drawing off the water, and, in this manner, placing the animals in the condition to which they are accustomed when the tide is out. Of course this treatment is only applicable to those animals and plants naturally living between tide-marks; for, except in the case of some of the blennies, and a few other small fishes, this exposure to the atmosphere is unsuited to the habits of free-swimming animals. The appearance of the *Actiniæ*, and other soft-bodied creatures, when left thus exposed is often so unlike their condition, when immersed, as to give rise to the suspicion of their being in an unnatural state; but experience tells us that these animals thrive best when subjected to this periodical exposure, and they show renewed vigour on the subsequent rising of the artificial tide. A great advantage is also gained by returning the water in a small stream to its place in the tank; by this means the whole of it undergoes purification in its passage through the air, and becomes better fitted to support life. We need only take a glance at the rocks at low water to satisfy ourselves that periodical exposure to the atmosphere is almost one of the necessary conditions of life with many species of marine animals. Some of the sea-anemones are found so high up in the range of tide that they must necessarily be out of the water for at least six hours of the twelve occupied by its ebb and flow; and if we go lower down and look under the large boulders, and into the dark crevices of the rocks, we shall find a multitude of creatures, and many of them of the most delicate structure, which, for an hour or two in every tide, are quite out of reach of the water. Marine animals can bear this exposure better than the inhabitants of fresh water; the salts held in solution in sea-water retain a moist atmosphere around the bodies of the various animals which have been bathed with it, and evaporation consequently does not take place very rapidly, so that we need not fear imitating Nature even in what, at first sight, appears to be a hazardous proceeding.

The temperature of the water in the aquarium is also a point requiring some attention, and its regulation will be found in a great measure dependent on the proper management of the light, especially in small tanks, where if the direct rays of the sun are allowed to fall for any length of time during the summer months, the water speedily becomes lukewarm, a degree of heat at once fatal to deep-water animals. The average temperature of the sea at a moderate depth is about 56° Fahr., but the surface water during calm hot weather reaches a much higher standard. This is more perceptible in the quiet bays and creeks along the coast than in the open sea, since the action of the tides is less felt there, and the particles of water being *comparatively* motionless, are exposed for a longer time to the influence of the sun's rays. At that time few animals come to the surface. It is in the evenings of such still days, when the temperature has fallen, that the whole sea appears to swarm with life, and sparkles with myriads of phosphorescent *Medusæ*.

The *Actiniæ*, being for the most part attached to the rocks, and unable to remove quickly from an extreme temperature, are rarely found high enough to be exposed to it for any length of time. Those species living nearest to high-water mark, *Act. mesembryanthemum* for example, are the most capable of enduring the greatest fluctuations of temperature, and are consequently the easiest to keep alive in the aquarium, where, unfortunately, the natural conditions of their existence are not so uniformly maintained. Most of the species found between tide-marks, however, can adapt themselves to a gradual increase of warmth, and will endure without apparent harm from 50° to 70° of heat. This is a high range when we consider the usual temperature of the sea. For shore-loving animals, 60° will be found most conducive to health, and five or six degrees less for those inhabiting deep water.

In tropical climates, where the average temperature of the surface-water is many degrees higher than in our seas, we meet with a great variety of zoophytes peculiar to those regions; such waters are the homes of a large proportion of the coral polypes—animals agreeing in all the essential parts of their structure with the *Actiniæ* found on our own shores—but possessing the power of separating from the sea-water the lime with which they build up the various well-known forms of white coral. With a few exceptions these animals are confined to the warm seas of the tropics, where to a great extent they take the place of the true *Actiniæ*, and from their being restricted to these warm localities, we may reasonably conclude that the high temperature of the water is an important condition of their existence. The great Gulf-stream also, which is 10° or 12° warmer than the adjacent parts of the Atlantic Ocean, is inhabited by many curious animals, found only amidst its heated waters, so that evidence is afforded to us from various directions that particular degrees of warmth are suitable to the nature of the animals living in different parts of the world, and to keep our native species in a healthy condition in the aquarium, we must endeavour to secure for them the degree of equable temperature to which they are accustomed.

The specific gravity or density of the water in our artificial rock-pools, is another point requiring notice.

Sea-water, containing various salts dissolved in it, is so much heavier or denser than pure fresh water by the additional weight of those salts, and its specific gravity is measured by comparison with that of fresh water, which is represented by the number 1000. Taking this as a standard, we find the heavier water of the sea possesses a specific gravity of 1026 at the ordinary temperature of 60° Fahr., and this degree of density is tolerably uniform in the water around our coasts. In the aquarium, where the quantity of water is comparatively small, the density is affected by circumstances which are hardly felt in the sea. Such are the extreme fluctuations of temperature consequent on the tank being placed in an inhabited room, where the artificial heat by day may affect the water, and raise it as many degrees above, as the subsequent cold at night may reduce it below the natural standard of the sea. As water expands by the action of heat, any increase or diminution of the temperature must be attended by a corresponding variation in the volume of the water; or in other words, if the same weight of water is expanded so as to occupy a greater space, its density must be lessened in proportion: and on the other hand, if the volume of water be diminished by the influence of a lower temperature, its density or specific gravity must be augmented; for it must be remembered that the quantity of salts remains the same under any degree of temperature; and it is the fluid only which changes its volume, and consequently its relative proportion to the salts. Another more permanent source of derangement arises from the absolute loss of water by evaporation; but this defect, serious as it is if carried to any extent, is easily remedied by the addition of distilled or filtered water, until the density is reduced to the natural standard. When pure water is added to that in the aquarium, care should be taken to mix them thoroughly, as from the greater lightness of the fresh water, it naturally tends towards the surface. The glass specific gravity bulbs now in such general use, are invaluable as simple tests of the density of the water, indicating not only the unnatural condition arising from evaporation, but also the more delicate changes consequent on variations of temperature, or imperfect mixing of the fresh and sea-water. Thus, if the glass bubble be adjusted to the exact density of the sea, at a temperature of 60° Fahr., it will remain suspended in any part of the water in which it is placed, as long as that water continues in a proper state; but if the density is lessened by an increase of heat, the bubble will fall to the bottom of the tank, or if the water becomes colder, and its density in consequence greater, the bubble will ascend to the surface. This last circumstance may be frequently noticed on examination of the aquarium the first thing in the morning. A cold night will sometimes reduce the temperature of the water, so that the glass bulb will be found floating at the surface; but as the air in the room becomes warmer, the water recovers its proper density, and the bubble gradually descends. This simple occurrence may be sometimes misunderstood, and an addition of fresh water be made to the aquarium,

from a belief that the appearance of the test at the surface indicated an excessive density arising from evaporation.

Two specific gravity bulbs will be found most convenient for ordinary use in the aquarium, one of them being so adjusted as to sink slowly in good sea-water, and the other to rise in it as gradually; in fact, one to be a little heavier, and the other a little lighter than the water, so that when all is going on well, the glass bubbles will be widely separated; if, however, the density is too great, both bulbs will be at the surface; or on the contrary, if the water becomes too light from any excess of temperature, the only probable cause of such a result within doors—both bulbs will be at the bottom of the tank.

This plan of using two tests was introduced by Mr. W. A. Lloyd, of Portland Road, and admirably answers its purpose of showing the condition of the water in all parts of the aquarium.

We must now say a few words on the form of tank best adapted to carry out the principles of which we have been speaking.

Nothing is easier than to construct an aquarium; we have only to provide a vessel of glass, stone, or other hard material, fill it with water, stock it with animals and plants, and the thing is done, and may perhaps last for days, weeks, or even months, without anything going wrong. But we want something more than this. Our object is to keep the same water for an unlimited time, and to preserve the animals in a healthy state for as long a period as they would live if they were in their natural habitation, the sea, and to do this with the least trouble to ourselves. Moreover, we want to see everything in the aquarium under the best possible light, not necessarily in a blaze of sunshine, but with the illumination so managed, that whilst the animals are well shown, there may be plenty of shade behind to relieve their various forms, and to produce something like a picture.

This result may be perhaps more readily obtained in the Slope-backed Tank, suggested by Mr. Warington, than any other. The advantages of this form of aquarium are numerous. If the tank is placed close to a window, the light will fall on the sloping back in a slanting direction, not very far from the perpendicular, and may be regulated to a nicety by the aid of an ordinary blind, the gradual lowering of which will produce as gradual a diminution of the light. The rockwork should be arranged along the back of the tank, so as to produce a number of irregularly projecting masses, and as the light is admitted only from behind, numerous dark crevices and shady places will be the result, and these are the situations especially frequented by almost all shore-loving animals; for although many of them enjoy a certain quantity of light, they all like to be able to return to shelter, and to hide themselves from their enemies. These dark places are also useful in affording clean surfaces for the attachment of the polypes, as the absence of light prevents the growth of vegetation.

The sloping back enables us to fit up the rockwork in a tank with the least amount of trouble, for if we begin at the bottom, and pile up stones of various sizes one behind the other, we must necessarily produce the dark places of which we have spoken, and there will be no

occasion for the *possibly* ornamental but unnatural "Stonehenge" like structures so commonly introduced into tanks of the ordinary form.

Finally, the entire contents of the sloping tank may be seen at one view through the front glass, and it need hardly be mentioned that this is an important consideration, when the object is to study the habits of our prisoners.

We shall perhaps be told, that all these conditions may be obtained in any form of tank, and such undoubtedly is the case, but we prefer the slope-backed tank, because it presents fewer difficulties in their attainment, and when established, an aquarium of this form is less liable to get out of order.

A few words on the question of feeding the *Actiniæ* may perhaps be admissible. It is generally believed that these animals require no other food in the aquarium than the minute creatures with which sea-water usually swarms. Such may be the case in large tanks, where the quantity of water is proportionately greater, and the animals less crowded; but we find from experience, that in an aquarium containing only a few gallons of water, the *Actiniæ*—although apparently healthy—diminish in size if kept in the same water for many months without a fresh supply of food, and this decrease does not take place if they are occasionally fed with small bits of meat. Beef and mutton, either raw or partially cooked, are readily eaten by all our sea-anemones, and although certainly not their natural food, are convenient substitutes for it, from being always within reach; care should be taken, however, to give the meat in very small bits, and to remove from the water whatever remains of it are cast up by the polypes.

In pointing out the difficulties met with in the proper management of the aquarium, it is far from being our wish or intention to discourage those persons who endeavour to naturalise within their houses the various tenants of the sea. Our object is rather to call attention to those great natural laws whose operation should be imitated, if we wish for success in our miniature rock-pools. We have seen that in the sea, a moderate light is sufficient for most of the animals living between tide-marks, and that light is only admitted to them from above; a uniform temperature and specific gravity of the water are maintained, and a ceaseless motion kept up. Such are the conditions we must imitate in the aquarium, and with a judicious selection and arrangement of the plants and animals, success in its management may be certainly expected.

The aquarium provides amusement for many a leisure hour to those who will take the *little* trouble necessary for its establishment and maintenance, and to the naturalist it affords valuable means of investigating the economy of marine animals, which without its aid would be almost beyond his reach. Much, however, remains to be done in extending its application, and making it available for the productions of deep water or of foreign climates, and when the mode of transporting delicate creatures from a distance is better understood, tropical seas, and even coral reefs, may contribute to our stores, and enable us successfully to carry out the idea of a true Water-Menagerie.

## III.—FRESH-WATER FISHES.

The necessary separation of the fresh-water fishes in the aquarium from the strictly marine species renders a similar arrangement desirable in describing them, and, by adopting this plan in the Handbook, greater facilities will be given for reference, and the particular habits of the various species will, perhaps, be more strongly impressed on the visitor. It need hardly be said, however, that such a distinction is not warranted by any structural peculiarity; for we find closely-allied fishes differing in their natural habitation, and some few which frequent both fresh and salt water.

**The Perch** (*Perca fluviatilis*) is found in all the temperate parts of Europe, and is abundant in most of the rivers and lakes of England, but it is less common in Scotland, and is not met with at all in its northern counties. This fish does well in the aquarium where it will feed voraciously on earthworms and small fish, and if kept well supplied with suitable food it will survive many years. Some of the perch which were exhibited in the Fish-house when it was first opened in 1852, are still alive. They generally spawn in April or May, depositing their ova among the water plants growing in the tanks, and it has been observed by the attendant in the house, that the high temperature of the water during a warm spring considerably hastens the hatching out of the young fish. Some of those produced in 1857 are now alive and likely to do well.

**The Ruffe or Pope** (*Acerina vulgaris*) very much resembles the perch in shape. It is a common fish in many parts of England, and is very abundant in the Thames.

**The River Bullhead or Miller's Thumb** (*Cottus gobio*) is found in most of the mill-streams and running waters of this country. Its habit is to lurk amongst the loose stones at the bottom, where it watches for aquatic insects and other kinds of food. The common name of "Miller's Thumb" is given to this fish from the resemblance of its broad flattened head to the peculiar shape of the thumb of a miller produced by its frequent exercise in examining the meal.

**The Common Carp** (*Cyprinus carpio*). This well-known fish is generally found in still waters, and thrives better in lakes or ponds than in rivers. It feeds principally on aquatic plants, but will also eat worms and insects, and in suitable places, is said to live to a great age, even to as much as one hundred and fifty or two hundred years. It appears to be very sensitive to cold, and in winter is supposed to hybernate, taking but little food, and hiding itself in some sheltered situation.

**The Crucian Carp** (*Cyprinus carassius*) **and the Prussian Carp,** (*C. gibelio,*) are both found in the neighbourhood of London, the former only in the Thames, the latter in ponds adjoining it, as well as in many other parts of England.

**The Gold Fish** (*C. auratus*). This species of carp was introduced into Europe from China, probably about two hundred years ago. It breeds freely in most of the ornamental waters of this country but increases much more rapidly in ponds which have their temperature artificially raised and

maintained at about 80 degrees. Some of these fish reproduced in one of the tanks, in 1855, and the young are still alive, and have now assumed the bright colour characteristic of the species.

All the species of carp are in a great measure vegetable feeders.

**The Bream or Carp-Bream** (*Abramis brama*) is met with in most of our sluggish rivers, and large lakes; it is an active fish, generally swimming in shoals, and affords amusing sport to the angler.

**The Barbel** (*Barbus vulgaris*) is very abundant in the Thames, where it grows to a large size; it feeds voraciously on worms and small fish. In the aquarium it is very restless, continually turning over the stones and gravel at the bottom of the tank in search of food. Specimens of the barbel have lived for upwards of four years in the Fish-house.

**The Gudgeon** (*Gobio fluviatilis*). This well-known fish is abundant in all the rivers in the neighbourhood of London, and is found in most of the other English streams. It does tolerably well in the aquarium, but thrives best in running water. Its food consists of worms and various aquatic animals.

**The Tench** (*Tinca vulgaris*) is a fish delighting to hide itself among weeds and in holes under banks, and from this circumstance is not very suitable for exhibition in the aquarium. It is, however, very hardy, and will live for a long time in a small quantity of water. The tench spawns in June, and deposits its ova among the stems of certain kinds of aquatic plants. It feeds on various soft animal substances, worms, and occasionally vegetable matter. There is a curious report current about this fish having the power of exercising the healing art on any of its companions that may be sick or injured. The name of "Doctor-Fish" has been applied to it in consequence, but nothing can be discovered in support of the truth of the story, and the origin of the report is unknown.

**The Roach** (*Leuciscus rutilus*) is one of the commonest of our fresh-water fishes, and is met with in almost all the still waters and sluggish streams of the temperate parts of Europe. It swims in shoals, feeding on worms, and readily takes a bait, but is held in little estimation for the table. A rare species of roach, termed the Azurine, or Blue Roach (*L. cæruleus*), has also been exhibited in the Fish-house. In this country it has only been found in the neighbourhood of Knowsley in Lancashire, and may easily be recognised by the slate-blue colour of its back. It appears to be equally rare on the Continent, but is said to inhabit some of the Swiss lakes.

**The Dace** (*L. vulgaris*) and **The Bleak** (*L. alburnus*) are well known in all the rivers in which the roach is found. The silvery-white pigment deposited on the inner surface of the scales of the bleak and some other fish, is largely employed by artificial pearl-makers to give a lustre to their wares.

**The Minnow** (*L. phoxinus*). This handsome little fish is too well known to require any description. It is very hardy in confinement and always looks well. Minnows have lived for many years in the Zoological Gardens, and have occasionally deposited their spawn among the aquatic plants growing in the tanks, but no young ones have been produced. In the spawning season the front part of the head becomes covered with small scale-like tubercles which give a curious appearance to the fish.

**The Loach** (*Cobitis barbatula*) frequents rivers and small streams and

passes much of its time on the ground lurking under stones; when disturbed, however, it swims rapidly with a peculiar wriggling motion. Worms constitute its principal food. It is by no means a difficult fish to keep alive, but it often escapes notice in a tank from its habit of hiding among the stones at the bottom. If not on the ground it will generally be found resting on some of the rock-work, for it appears to be incapable without great effort of remaining suspended in mid-water.

**The Pike** (*Esox lucius*) attains the largest size of any of our fresh-water fish, and is believed to live to a very great age. It is generally distributed through almost all the lakes and many of the rivers of the British Islands, and is everywhere known for its excessive boldness and voracity. Its habit is to remain under the shelter of water-plants until some passing fish attracts its attention, when it darts like lightning on its victim. No kind of animal food comes amiss to its insatiable appetite, and various stories are on record of this fish having seized animals considerably exceeding itself in size. Of the specimens exhibited in the Fish-house, one has lived there for more than five years. They are fed on frogs, fish, birds, and sometimes half-grown rats and appear always ready for any kind of animal food. It has been found necessary to cover the tank containing these fish with a net, as on more than one occasion a specimen has jumped out during the night.

**The Salmon** (*Salmo salar*). Great difficulties attend the rearing of such a delicate fish as the salmon in the little space that can be devoted to it in the Fish-house; the periodical change of habitation from fresh-water to salt—the supply of natural food, and other things necessary for the well-being of this fish can hardly be provided in an artificial state, so that it appears almost hopeless to attempt the preservation of this species beyond its early stages of growth. In this condition, the salmon was exhibited in 1857, through the kindness of Mr. Samuel Gurney, who supplied the Society with several young fish which had been hatched only a few days. These little fish lived for some weeks, and before their death, assumed all the characteristic markings of the Parr. The adult salmon leaves the fresh-water in the spring, and after slowly travelling to the sea, where it acquires renewed vigour, it returns to the rivers to deposit its spawn. It was once believed that salmon always came back to their native stream, but some experiments with marked fish have proved that this is not invariably the case.

**The Common Trout** (*Salmo fario*) is only a little less difficult to keep alive in the aquarium than the salmon; it will, however, thrive in shallower water, and if supplied with a stream of good water and a proper allowance of food, will live for some time in a moderate-sized tank. The largest of the two specimens now exhibited was presented to the Society by Mr. Gurney in April, 1857, and was then only just hatched and about three-quarters of an inch long; its present length is nearly nine inches, and except in being rather dark in colour the fish has a strong healthy appearance and feeds voraciously on minnows and other small fish. The smaller specimen was hatched in the Fish-house from some spawn also presented by Mr. Gurney on the 1st of March, 1858. From this spawn five or six fish were produced on the 15th of April, but only one of them has survived to the present time. The trout is exceedingly voracious, and commits great havoc among the smaller species of fish, besides feeding on worms and insects. An ordinary-sized trout that was kept for some months in one of the tanks used to consume from fifteen to

twenty minnows and gudgeon in the course of a day. It was killed at last by an accidental stoppage of the stream running through the tank.

**The Grayling** (*Thymallus vulgaris*) is closely allied to the trout, and is found in many of the English streams, but is more local in its distribution, and from that circumstance was supposed to have been introduced into this country from the Continent; the quality of the water, however, and the nature of the ground, are probably the causes which induce this fish to select particular streams. It resembles the trout in most of its habits.

**The Smelt** (*Osmerus eperlanus*) like the salmon, passes the winter in fresh water, and returns to the sea on the approach of warm weather. It is most abundant on the eastern coast of England, and does not appear to be known along any of the counties bordering the English Channel. Its place is there taken by another fish, which, although commonly known as the smelt, really belongs to a distinct species, named the Atherine. The true smelt is caught in great abundance in different parts of the Thames, and the fishermen at the mouth of the river and in the Medway supply most of those which are brought to the London markets. Shrimps are said to be its principal food.

**The Burbot** (*Lota vulgaris*). This fish is the only British species of the Cod family that is entirely confined to fresh water. It frequents sluggish rivers in many parts of England, but is nowhere very numerous; its food consists of worms, insects and small fish.

**The River Lamprey** (*Petromyzon fluviatilis*). **The Sandpride, or Mud Lamprey** (*Ammocœtes branchialis*).

These two fish were for a long time considered as distinct species, but the recent observations and experiments of M. Auguste Müller lead to the conclusion that the Mud Lamprey is only the young of the common Lamprey or River Lamprey. Many peculiarities in their structure point to a low position in their class, and a departure from the typical organisation of true fishes. The skeleton is almost entirely composed of cartilage, very little bony matter being deposited in any part of their frame. The mouth is more or less circular when open, and forms a sucking disc, by which the fish is enabled to adhere to stones at the bottom of the rivers it frequents. Lampreys feed on various soft animal substances, and the marine species—the one so highly prized for the table—is said sometimes to attack large fish, and to eat its way into their bodies by means of the sharp teeth with which its curious mouth is furnished. Some of the lampreys are found in most of the European rivers.

---

## IV.—MARINE FISHES.

**The Basse** (*Labrax lupus*) is abundant along the southern coast of England, frequenting the mouths of rivers and sometimes passing along their course for some distance. It usually keeps near the shore, from which it may be caught by means of a baited hook thrown in the tideway. At certain seasons of the year, this fish is observed to spring entirely out of the water, making two leaps in quick succession. It is closely allied to the common fresh-water perch.

**The Streaked Gurnard** (*Trigla lineata*). Several species of Gurnard are found on the English coast. They are all remarkable for the large

size of their fins, which, with their plated wedge-shaped heads, give them a very peculiar appearance. Most of those brought to the markets are obtained from deep water by means of the trawl, a large flattened funnel-shaped net, extensively used on the Devonshire coast. The Streaked Gurnard is the only species that has been exhibited in the aquarium. All the gurnards possess the power of emitting a curious grunting sound.

**The Father-Lasher** (*Cottus bubalis*). **The Four-horned Cottus** (*C. quadricornis*).

These two marine species belong to the same group as the Miller's Thumb, already noticed as inhabiting fresh water. The Father-Lasher is abundant on all our rocky shores, and may be easily known by the long spines on the top of its head, and the large pectoral fins which are usually spread out on each side of its body like enormous hands. It is a very hardy fish, and well suited for the aquarium, where it will live for a long time, and will eat all kinds of animal food. It will survive for a considerable time after it is taken out of the water.

The Four-horned Cottus is a much rarer species, and may be recognised by the four blunt spines at the back of the head.

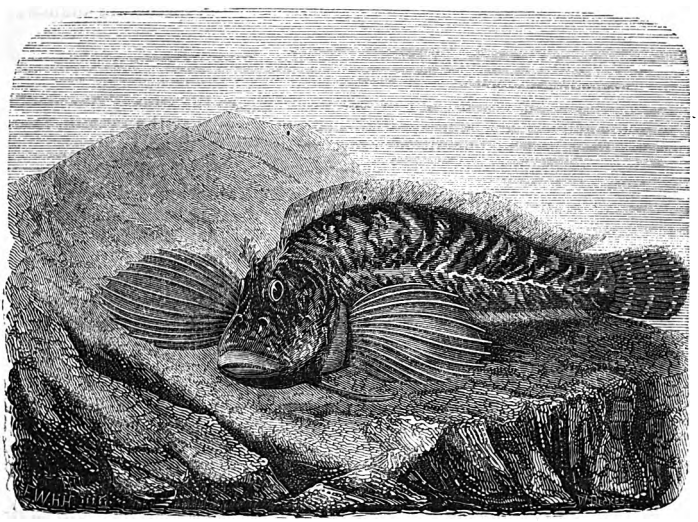
**The Armed Bull-head** (*Aspidophorus Europeus*) somewhat resembles the two preceding species, but has the body covered with scaly plates, and three spines at the tip of the nose. It is frequently taken by the shrimpers at the mouth of the Thames, and is very numerous along the eastern coast.

**The Ten-spined Stickleback** (*Gasterosteus pungitius*), **the Fifteen-spined Stickleback** (*G. spinachia*), **and the Rough-tailed Stickleback** (*G. trachurus*).

Of the seven kinds of stickleback found in this country, the Fifteen-spined species is the only one essentially marine; the others are able to exist in either fresh or salt water, and are met with in ponds or ditches, and streams along their whole course to the sea. The above-mentioned species have been exhibited on several occasions in the Fish-house, and the two last have there gone through the curious process of nest-building, a habit probably common to all the species of this group. The nest is generally commenced in April or May, and is the work of the male fish alone. It is at this time the little worker assumes the brilliant colours which render it such a conspicuous ornament for the aquarium; it then becomes more than usually pugnacious, and will not suffer any fish to approach the spot in which its building operations are carried on. In a paper communicated to the British Association in 1852, Mr. Warington has given an interesting account* of the manner in which the small roots and stems of aquatic plants are collected and arranged by the fish, each little fibre being examined, and its fitness tested before it is conveyed to the nest, where it is duly secured in its position by grains of sand and small stones placed upon it. The construction of the nest occupies only a few days, and when completed, the male fish uses every possible device to induce the female to deposit her eggs in the place prepared for them, and if his invitation be not responded to, he even resorts to force, and seizing her by the fins or tail, tries to drag her to the nest. After fourteen or fifteen days the ova are hatched; the nest is then destroyed, and the male fish keeps vigilant guard over his young family, and defends them from the attacks of other fishes in the neighbourhood. The sticklebacks feed on small worms and the aquatic larvæ of insects.

* Also published in the *Leisure Hour*, page 764. Nov. 25, 1852.

**The Grey Mullet** (*Mugil capito*) is perhaps better known in the aquarium than any other kind of sea-fish. It soon becomes tame, and requires but little management to keep alive for several years. In a natural state this fish frequently changes its quarters from salt water to fresh, and returns to the sea with the ebb tide. It seldom goes far from the land, but delights in quiet sheltered bays, where large shoals of them may be often seen in fine weather, playing about just at the surface of the water. Some of the green seaweeds appear to be a favourite food of the Grey Mullet, but it will also devour worms, and may be taken with an artificial fly. Nets, however, are the usual means employed to capture it, but it frequently makes its escape by jumping over the headline when the net is almost close to the shore. There are three species of Grey Mullet found on our coasts.



THE CRESTED BLENNY.

**The Ocellated Blenny, or Butterfly-fish** (*Blennius ocellaris*), **the Crested Blenny** (*B. Yarrellii*), **the Shanny or Smooth Blenny** (*B. pholis*).

The blennies are hardy voracious fish and do well in confinement. They frequent rocky coasts, hiding themselves in crevices and under stones, and may be constantly found in the small rock-pools left by the retiring tide; it is no uncommon occurrence for them to remain for several hours exposed to the air, under shelter of a bit of weed or stone; indeed, there are very few fish which will live so long out of their natural element. The same habit is observed in them when kept in the aquarium, where they will often leave the water, and remain for hours exposed on the projecting rock-work. Their natural food consists of various kinds of shell-fish.

**The Spotted Gunnel, or Butter-fish** (*Murœnoides guttata*), is closely allied to the blennies, and is very common under stones between tide-marks.

**The Viviparous Blenny** (*Zoarces viviparus*) has much the same habits as the true blennies, but differs from them in producing its young alive, the ova being hatched before they are excluded from the parent. It is not uncommon on our eastern coast.

Six species of Goby have been recognised in the British seas, and of these, the scarce **Black Goby** (*Gobius niger*), **the Freckled Goby** (*G. minutus*), **the One-spotted Goby** (*G. unipunctatus*), **and the Two-spotted Goby** (*G. bipunctatus*,) have been exhibited on various occasions. They are all amusing fishes, and from their small size are convenient occupants of the aquarium. The gobies are generally distributed around our coasts, living in shallow water, and some of the species are abundant on sandy shores.

**The Sordid Dragonet** (*Callionymus dracunculus*) is one of a group of fishes remarkable for the large size of their fins ; the position of the eyes placed on the top of a broad flattened head adds to the strange appearance of these animals and points to their habit of keeping at the bottom, from which they rise in pursuit of prey, darting with great swiftness and generally returning to the same spot.

**The Fishing Frog, or Angler** (*Lophius piscatorius*), is another most remarkable fish, a specimen of which, three feet in length, was sent up from Weymouth some little time since by Mr. William Thompson. Unfortunately, it was dead when it arrived at the Gardens, but, even in that condition it was an object of great interest to all who had an opportunity of seeing it. The breadth across the head of this fish measured nearly half its entire length ; the projecting lower jaw, fringed with a row of fleshy filaments, was surmounted by a mouth of enormous size, extending to nearly the width of the head, and possessing a set of large recurved teeth. The body tapered away very rapidly towards the tail, giving the fish the appearance of a gigantic tadpole. The most remarkable character of the species, and the one which has suggested the title of "Angler" is the presence of two long appendages to the top of the nose: these have great freedom of motion, and Yarrell in his *History of British Fishes* thus speaks of the manner in which the fish employs them :—

"The uses to which they are applied are singular. While crouching close to the ground, the fish, by the action of its ventral and pectoral fins, stirs up the sand or mud: hidden by the obscurity thus produced, it elevates these appendages, moves them in various directions by way of attraction as a bait, and the small fishes, approaching either to examine or to seize them, immediately become the prey of the Fisher."

The Fishing Frog is found in most of the European seas and is frequently taken on our coasts by the deep-sea fishermen.

**The Ballan Wrasse** (*Labrus bergylta*). **The Green Wrasse** (*L. lineatus*). **The Three-spotted Wrasse** (*L. trimaculatus.*) **The Connor** (*Crenilabrus melops*). **The Corkwing** (*C. norwegicus*). **Jago's Goldsinny** (*C. rupestris*).

Seven species of wrasse besides those above-mentioned are found in the British seas. They are all more or less tinted and variegated with bright colours, and some of them are strongly marked with spots or stripes. The localities frequented by these fish are usually rocky coasts, to which they resort in search of small crustacea and certain kinds of shell-fish. The

wrasses appear to be hardy, and will survive in the aquarium under conditions fatal to many other kinds of sea-fish.

**The Dorse or Variable Cod** (*Morrhua callarias*). **The Coalfish** (*Merlangus carbonarius*).

Both these members of the cod family are northern species. The Dorse, remarkable for the great variation in its colouring, is found abundantly in the Baltic, but is rarely met with in our own seas. The Coalfish is common on many parts of the coast, but increases in numbers as we proceed northward. It is highly esteemed as an article of food, and has been kept with some success in large salt-water ponds, where it soon becomes tame, and attains a large size.

**The Three-bearded Rockling** (*Motella tricirrata*). **The Five-bearded Rockling** (*M. quinquecirrata*).

These fish are frequenters of rocky coasts and are generally distributed in all the suitable localities around our islands; they feed on minute animals of various kinds, and their habit is to remain for a long time almost motionless under shelter of a bit of seaweed or a projecting rock. All the rocklings possess fleshy barbules at the extremity of the jaws and these flexible appendages probably serve to attract the various minute animals which these fish devour.

**The Flounder** (*Platessa flesus*). **Bloch's Topknot** (*Rhombus punctatus*). **The Turbot** (*R. maximus*). **The Sole** (*Solea vulgaris*).

Few fishes are perhaps so little generally understood as those popularly known as "*Flatfish*," although their appearance must be familiar to every one. Whilst other kinds freely range through the waters at various depths, the different species of flatfish have their homes on sandy or muddy bottoms, and their whole structure is modified to adapt them to those particular kinds of locality. Swimming as they do on one side, and close to the ground, an equal development of fins and other organs on both sides would be inconvenient as well as useless. On comparing their shape with that of other fishes, we find it more or less deformed or unsymmetrical, the head is apparently twisted round so that both eyes are on the upper side, and the fins on the same surface are developed to a greater extent than the lower ones, thus by their unequal action assisting the fish to keep on its side. The eyes of flatfish are generally placed on the right side; when on the left, the fish are said to be *reversed*. Excepting the Flounder, which inhabits both fresh and salt-water, all the species of flatfish found in this country are marine.

The Flounder lives well in the aquarium, and exhibits more activity than might be expected, frequently coming to the surface and sometimes swimming about in mid-water with a peculiar hovering motion. The common earthworm is a favourite article of food with it, and indeed is readily eaten by every species of the finny tribe to which it has been offered. Only young examples of the other kinds of Flatfish above mentioned have been kept, and they did not survive their capture more than a few weeks. They are all inhabitants of deep water. Bloch's Topknot is peculiar in having the first ray of the dorsal fin very much elongated, so as to form a filamentary appendage. It is a very rare species. The Sole and Turbot are too well-known to require any description; the fisheries for them are among the most important on our coast, and are carried on both by net and line for the Turbot but by net only for the Sole. Of this last popular fish, Mr. Yarrell relates, that "eighty-six thousand *bushels* have been received at

Billingsgate within twelve months," and nearly eighty-eight thousand Turbot in the same time.

**The Bimaculated Sucker** (*Lepidogaster bimaculatus*). This pretty little fish attracts much attention in the aquarium from its habit of adhering to the glass sides by means of a peculiar arrangement of the pectoral and ventral fins; each pair of these fins is connected by a membrane so as to form one-half of a nearly circular sucker, and by their united action the fish fastens itself to any convenient surface. If taken out of the water it will adhere firmly to the hand. Examples of this fish are not uncommon along our south-west coast; they may be found under stones at low-water mark and are often taken by the dredge in greater depths. Another somewhat larger species, the Cornish Sucker, is found, as its name implies, on the coast of Cornwall, and from its being also abundant on the rocky shores of Guernsey, it is probably essentially a southern species.

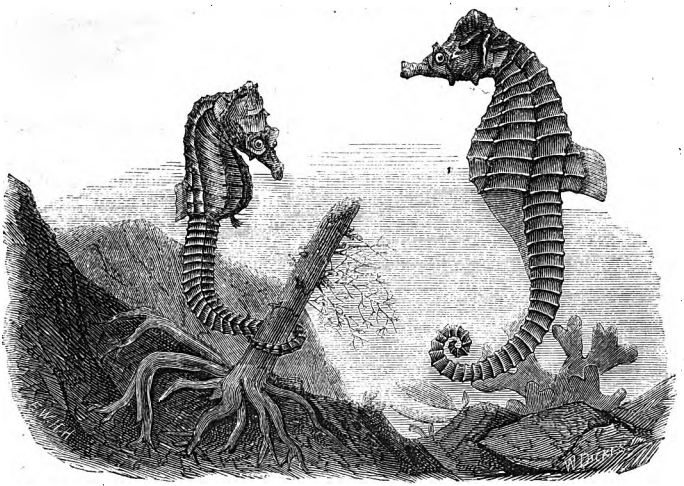
**The Conger** (*Conger vulgaris*). This marine eel grows to a large size; examples have been killed weighing upwards of a hundred-weight and measuring ten feet in length, and eighty or ninety pounds is not an uncommon weight for this fish along the Devonshire and Cornish coasts. The conger is a shy fish, frequenting rocky shores and hiding itself from observation among the stones and crevices of its haunt. It is taken by long lines, and the fishing for it is only successful at night. A young specimen of this fish has lived in one of the tanks since 1853. On its arrival it measured only five inches, but is now upwards of two feet in length; it passes most of its time in a hole it has excavated under some of the rock work, and in the cold weather never moves from its shelter, but during the summer months it will often come out to be fed at a signal from the attendant in the Fish-house.* The conger is extremely voracious, and preys on various kinds of fish.

**The Great Pipe-fish** (*Sygnathus acus*). **The Deep-nosed Pipe-fish** (*S. typhle*). **The Æquoreal Pipe-fish** (*S. æquoreus*). **The Snake Pipe-fish** (*S. anguineus*). **The Worm Pipe-fish** (*S. lumbriciformis*).

All the above species have been exhibited in the aquarium. The pipe-fishes are among the most peculiar of our British fishes, and in addition to their long worm-like form, are remarkable for the variety of strange positions they assume as well as for their habits. They generally maintain a nearly erect attitude, supporting themselves in the water by a peculiar undulating movement of the dorsal fin; in some of the species, this fin is the only one present. A curious point in their anatomy, which has been repeatedly verified, is the existence of an abdominal pouch in the *males* of some of the species, and little cup-shaped depressions placed in a similar situation in others. In these cavities the eggs deposited by the female fish are lodged, and remain until hatched. It is not known in what manner the male fish obtains possession of the ova, but in every case that has been examined, it has been proved that the male is the nurse, and the female is unprovided with any external means of carrying the eggs. The mouth of the Pipe-fish is prolonged in the form of a tube, and as the orifice is capable of but little dilatation the food of these animals must necessarily be small. They are all marine, and are common on many parts of our coasts, frequenting *Zostera* beds and weed-covered shores.

* The writer is indebted to J. Tennent, the Keeper of the Fish-house, for the above notice of the habits of the Conger in confinement as well as for other interesting observations of many of the animals under his charge.

**The Short-nosed Hippocampus or Seahorse** (*Hippocampus brevirostris*). Four specimens of this curious fish were presented to the Society in the summer of 1859 by J. F. Pinto, Esq. They were taken in the river Tagus, where they are said to be not uncommon. The Hippocampus is closely allied to the pipe-fishes, but differs from them all in the shape of the head, which from its grotesque resemblance to that of a horse has suggested the name of "Seahorse," by which the fish is generally



THE SHORT-NOSED HIPPOCAMPUS, OR SEA-HORSE.

known. The tail is prehensile, like that of some of the South American monkeys, and is employed to support the fish by being curled round the stems of sea-weeds; in this manner the Hippocampus spends the greatest part of its time, occasionally changing its position or swimming with its body erect to some other station. Many species of fish have the power of moving each eye independently of the other, and this curious habit is very marked in the Seahorse, the eyes being constantly turning in opposite directions, and adding to the singular appearance of this interesting little fish. The males of this species are furnished with an egg-pouch as already noticed in some of the pipe-fishes.

**The Small spotted Dog-fish** (*Scyllium canicula*), and **The Large-spotted Dog-fish** (*S. catulus*), have been kept alive for a short time in the aquarium; they belong to the Shark family, and although a small species, they display the same ferocious character as the larger kind so well known in tropical seas. As many as thirteen species of shark have been observed frequenting our seas; most of them are of small size, but the Basking Shark has been killed measuring as long as thirty-six feet.

Two other species of fish remain to be noticed—**the Monk, or Angel fish** (*Squatina angelus*), **and the Thornback** (*Raia clavata*). The Angel fish is intermediate between the Sharks and the Rays; it is not uncommon in deep water along our southern coast, and is said to attain a length of

seven or eight feet. The Thornback is one of our numerous species of Ray or Skate. These fish are almost flat, but unlike the Turbot and other fish of that description, have the body flattened vertically and swim with the back uppermost. They are all inhabitants of deep water, keeping at the bottom, and living on the various fishes frequenting the same localities. Some of the Sharks and the Rays produce their young in horny cases or "purses" as they are popularly called, and the dried remains of these egg-cases may be frequently observed cast up on the beach.

---

## V.—INSECTS.—SPIDERS.

Under this heading we may mention the two well-known Water-beetles, and the Water Spider.

These are all common in most of the ponds around London, as well as in many other parts of the country. **The Great Water Beetle** (*Hidrous piceus*) constructed its nest in one of the tanks during the summer of 1859, and several of the larvæ were hatched out. The nest or egg-case is composed of some fibrous material, probably of a silky nature, and is irregularly spherical in shape, with a long spine or spur projecting from the top. This specimen was attached to the shell of a living pond-snail (*Limnea stagnalis*). The second species of water Beetle is the common and destructive *Dytiscus marginalis*. **The Water-Spider** (*Argyroneta aquatica*) has much the same habits as the ordinary land species, except that it constructs its web under water among the stems and leaves of plants, and feeds on aquatic insects.

---

## VI.—CRUSTACEANS.

The Crustacea include the various species of Crab, Lobster, and Prawn, with numerous other minute animals whose bodies and limbs are also encased in a hard shelly covering.

Of the Crabs, the following have been exhibited, viz:—

**The Long-legged Spider-Crab** (*Stenorynchus phalangium*). **The Spinous Spider-Crab.** (*Maia squinado*), an amusing species in the Aquarium. **The Great Crab** (*Cancer pagurus*). **The Shore Crab** (*Carcinus Mœnas*).

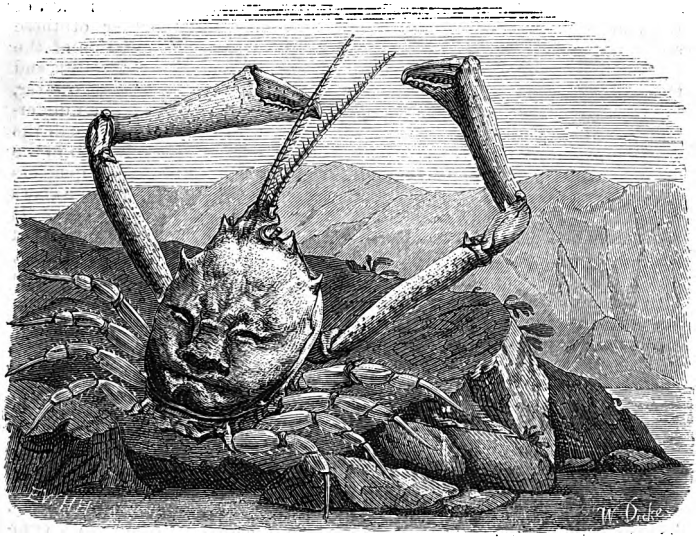
The Great Crab is the common species of which so many thousands are annually caught for the table; it frequents rocky places and grows to a very large size. When the crab is disturbed it has a curious habit of "shamming dead" and may be turned over and handled without its showing any appearance of life. The Shore Crab is abundant under stones between tide-marks. It is hardy in confinement, and very pugnacious.

**The Velvet Swimming-Crab** (*Portunus puber*). **The Cleanser Swimming-Crab** (*P. depurator*).

These crabs have the hind feet flattened and expanded so as to assist them in swimming. They are very abundant, and from their habit of feeding on all kinds of refuse animal matter are among the most useful of the sea-scavengers. They are commonly called *fiddlers*, from the peculiar motion of their swimming feet. **The Common Pea-Crab** (*Pinnotheres*

*pisum*) is a very minute species, having the strange habit of living within the shells of mussels, oysters, and other bivalves. **Pennant's Ebalia** (*Ebalia Pennantii*). This little crab lives in sandy places in which it burrows by means of its hinder feet.

**The Masked Crab** (*Corystes Cassivelaunus*) derives its name from the striking resemblance to a human face produced by the depressions and markings on the back of its shell. This extraordinary likeness is most conspicuous in full grown specimens where the regions of the body appropriated to particular organs have attained their mature form. The accompanying woodcut is a faithful representation of this species of crab,



THE MASKED CRAB.

and was taken from a fine specimen captured near the Eddystone, and now in the possession of T. H. Stewart, Esq. of the Royal College of Surgeons. The species is rather scarce, and is generally found on sandy bottoms in deep water. It has been only once exhibited alive.

**The Common Hermit, or Soldier Crab** (*Pagurus Bernhardus*), is one of the most amusing and restless animals in the aquarium. It lives in some old univalve shell suitable to its size, and the process of *trying on*, and examining a new dwelling is conducted in the most business-like manner. When the Hermit finds an empty shell, it begins by feeling it all over very carefully, and examines the inside with its claws to ascertain whether or not it is really empty. If everything is satisfactory, the crab comes out of its old home and in a moment slips its long hooked tail into the new shell where it at once seems to be quite at home. Sometimes the new premises do not altogether suit it, and the crab then looks about for another shell, or returns to the one cast off. When two Hermits meet,

there is sure to be a fight, each one endeavouring to turn the other out of his house, and the struggle generally ends by the stronger of the two keeping possession of the most suitable shell. The Parasitic Anemone commonly attaches itself to the shell inhabited by this species of Hermit.

**Prideaux's Hermit Crab** (*Pagurus Prideauxii*), is usually found in deeper water than the common species, and is not so pugnacious; it differs from it also in its habit of darting through the water with a swimming motion when disturbed, instead of crawling away over the ground. The most remarkable circumstance connected with this crab is its constant association with the Cloak Anemone, which is rarely if ever found unless attached to the shell inhabited by this species of Hermit. The Anemone adheres in such a position that its disk expands just below the mouth of the crab, so that whatever food comes within reach of either of these animals may be shared by its companion. This curious association of the crab and the zoophyte has been for many years a puzzle to naturalists, and the object of the companionship is still unexplained; Mr. Gosse, however, has recently proved that the association is not accidental, but that an understanding exists between the two animals that they should go through the world in company.* This gentleman one day observed a Hermit Crab in the act of changing its house; when it had taken possession of its new quarters it began removing the anemone from the old shell, inserting its large claws under the zoophyte and gradually separating it from its old support. It then placed its companion in a proper position on the new shell, and held it there with its claws until it had attached, occasionally giving it a pat, and pressing it close in order to hasten the process of attachment. The same operation was afterwards witnessed by Mr. W. Alford Lloyd in one of the tanks at his warehouse in Portland Road; and on the same premises the writer observed a case in which one of these crabs had changed its house, and after vainly endeavouring for nearly an hour to remove the anemone (a sickly specimen) from its old quarters, it came out of the new shell, and returned to the original one, apparently unwilling to desert its companion. Strange as the friendship between the two animals may appear, it is yet shared with another creature totally unlike either of them. A handsomely marked worm (*Nereis bilineata*) commonly inhabits the shell occupied by this species of crab, and has been observed stealing out under the legs of the Hermit to partake of the food it was devouring. The worm, however, does not immediately leave the shell when its companions change houses, but after a time, it comes out, and seeks another convenient hiding-place.

**The Hairy Porcelain Crab** (*Porcellana platycheles*) and **The Minute Porcelain Crab** (*P. longicornis*) are generally found in company, and are extremely abundant under stones on many rocky parts of our coast.

**The Scaly Galathea** (*Galathea squamifera*) much resembles a very small lobster; it may be often found under stones at low-water along our southern shores.

**The Common Crayfish** (*Astocus fluviatilis*) is a fresh-water species inhabiting most of the rivers of this country, and is met with in suitable situations in various parts of Europe. Its habit is to conceal itself as much as possible, and in confinement it accordingly occupies the darkest part of the aquarium, where it will live for a long time if the water

* *Zoologist*, June, 1859, p. 6580.

is frequently renewed, or kept well aërated. Its food consists of various aquatic insects and small animals.

**The Lobster** (*Homarus vulgaris*) is abundant on all the rocky coasts of our islands, which furnish a large supply for our various markets. A great proportion of the lobsters supplied to the London dealers is obtained from the coast of Norway; and it is stated that not less than 600,000 are annually received from that country alone. Lobsters are caught in pots made either of netting or basket-work; and they are occasionally captured by hook and line, although such occurrences can only be regarded as accidental, the bait intended for fish having been seized and appropriated by the lobster. One of these animals was put into the Fish-house in May, 1854, and lived there until June, 1856. During the interval it twice cast its shell: first, on the 18th of June, 1855, and again on the 6th of June, 1856. It died shortly after the second moult. The process of casting the shell was not observed, as on both occasions it took place during the night; but the operation has been witnessed elsewhere, and it is now ascertained that, after the body has been liberated by the longitudinal splitting of the front half of the shell, the limbs are pulled out of their cases without any fracture taking place, and this even with the large claws. On comparing the two shells cast in the aquarium, a difference in their measurements was found of half an inch in the length and circumference of the body, and three-quarters of an inch in the same parts of the large claws, showing the increase in size between the two moultings.

**The Common Shrimp** (*Crangon vulgaris*) frequents sandy and muddy shores, where it is taken in great abundance by means of large hand-nets. It is not an attractive animal in the aquarium, as it moves about but little, and its quiet colouring helps to conceal it on the ground.

**The Æsop Prawn** (*Pandalus annulicornus*) is a handsome species, elegantly marked with red lines and spots on various parts of its body and limbs. It is found all round our coasts, and its range extends far into the northern seas. **The Common Prawn** (*Palemon serratus*) is taken in large numbers in company with the Shrimp, but differs from that species in many of its habits, and usually frequents rocky rather than sandy shores; the larger specimens are caught in deep water over rocky ground by means of bag-nets suspended from buoys. Prawns are among the most interesting occupants of the aquarium, and are always attractive from their liveliness, and the beauty of their colours; these brilliant tints, however, soon fade if exposed to much light, and the animals themselves thrive best when provided with shady places in which they can hide when necessary. Every rock-pool left bare at low water is tenanted by some of these elegant creatures, and there they may be seen disporting among the varied forms of seaweed and waking up the stillness of the pool with their quick and graceful movements. Prawns are voracious feeders, and many a struggle do they have with the anemones in the aquarium for some choice morsel of food.

The young of most of the crustacea we have noticed undergo various metamorphoses before they attain the adult state, and the early stages of growth in several species of crab were for a long time considered as belonging to distinct animals. The Common Shore-crab is the only species that has been observed to breed in the Fish-house, and from this animal myriads of strange-looking little creatures of the size of a pin's head were one day excluded. The ova are carried under the abdomen of the parent, and when hatched, the young are thrown off with considerable force—

sufficient to carry them a distance of eight or nine inches. Very young prawns swim with their backs downward.

**The Sandhopper** (*Talitrus locusta*) swarms under every large stone on the beach; it feeds on dead animal matter, and is itself the favorite food of various kinds of fish and other inhabitants of the sea.

**The King-Crab** (*Limulus Polyphemus*). This most curious crustacean is one of the remaining forms of a group whose relics are so abundant in many of the formations in the Palæozoic period. The Limuli, Trilobites and other low-organised members of the class were then important inhabitants of our waters, but are now mainly represented by various minute forms of *Entomostraca*. This species of King-Crab is found on the Atlantic coasts of North America, keeping near the shore, and commonly hiding by burying itself in the sand. Like most of the crabs, it feeds on animal substances.

The most remarkable of our fresh-water crustaceans is *Chirocephalus diaphana*. It is rather more than an inch in length, and frequents the dirtiest pools and ditches, swimming about with its back always downward. It has been observed in only a few localities in England, and of its haunts in the neighbourhood of London, the best known are the ponds at Blackheath.

We may here notice *Argulus foliaceus*, a minute but curious animal, which lives parasitically on the pike, perch, and other fresh-water fishes. It may sometimes be seen swimming freely through the water, but is more commonly adhering to the fish by a pair of suckers placed under the body.

The *Argulus* is about a quarter of an inch long, with a nearly circular flattened body, and is sufficiently transparent to allow its whole structure to be seen with a magnifying glass. Although often attached to strong healthy fishes, it especially infests those which are sickly.

---

## VII.—CIRRHIPEDES, OR BARNACLES.

The internal structure of Barnacles shows them to be closely allied to Crustacea, although their general form is not such as to render the relationship very apparent. In the young state they are free swimming animals, with little resemblance to their parents; but whilst leading this wandering life, they undergo several changes of form, and at last, after attaching themselves to a permanent resting place, a final moult brings to light the characteristic features of the mature animal. Barnacles are usually divided into two groups, consisting of species whose shells are in direct contact with the rock or other substances to which they adhere, and those which are supported on a stalk or peduncle.

**The Acorn Shell** (*Balanus balanoïdes*) is a familiar example of the first group, and is the species which encrusts the rocks in such myriads all round our coasts. It is very hardy in confinement, and its little bunch of fringed fingers, or properly speaking, feet, is in constant activity, fishing for minute animals and sweeping them towards its mouth. *Pyrgoma Anglicum*, another small species, is peculiar in being constantly attached to the margin of the calix of our common British coral. *Verruca Strömia* is

also frequently adherent to corals; it may be recognised by the curious overlapping of many of the plates of the shell.

Of the Stalked species, **the Common Barnacle** (*Lepas anatifera*) and *Conchoderma aurita* have been exhibited in the collection. Both these species are commonly found growing on the bottoms of ships, and on pieces of timber which have been drifting about for some time in the open sea, and like most other animals which live at a great distance from land, they are not easily kept alive in the aquarium.

---

## VIII.—ANNELIDA.—WORMS.

Marine Worms are found in great variety along our shores, frequenting all kinds of locality, but generally sheltering themselves under stones, or in tubes of their own construction, so that their bodies are rarely visible in their entire length. Most of the worms are animal feeders, and those which construct a permanent tubular dwelling are dependent on the surrounding water for the means of obtaining subsistence. The study of marine worms has hitherto received but little attention, and our knowledge of their habits and specific characters is extremely scanty and indefinite.

**The Sea-mouse** (*Aphrodita aculeata*) is one of the handsomest of the class as well as the least worm-like in appearance, and is conspicuous by the brilliant iridescence of the bristles which clothe the upper surface of its body. Respiration is here carried on in a peculiar manner,—the water from which the oxygen is derived having been first filtered through a dense layer of felt on the back of the worm, then passes beneath a double row of valve-like plates, and bathes the whole upper surface of the body, making its escape at the posterior extremity, on the valves being closed. The Sea-mouse is commonly met with on muddy ground, and is rarely obtained without the use of the dredge.

*Polynoe squamata* is another worm having a dorsal layer of plates, but they are not hidden, as in the last species, by a thick covering of hair.

Several species of *Nereis* are found on our coasts, concealing themselves in crevices, and under the roots of seaweeds, the common Oar-weed (*Laminaria digitata*) being a favourite resort for many richly coloured members of this group of worms. The most interesting species, *Nereis bilineata*, has been already noticed in our account of the Hermit Crab.*

*Phyllodoce lamelligera* is one of a group of worms nearly allied to *Nereis*, but having the upper appendage of each foot flattened into a leaf-like form; when the animal is in motion these appendages are employed as paddles to assist in its progression, and materially add to the beauty of its movements. There are several species of the genus, the one mentioned above being among the largest, and attaining a length of two feet.

*Spio seticornis.* This little worm is extremely common on old shells, on which it constructs a tube of minute grains of sand, from the top of which project its two long thread-like tentacles. It is very hardy in confinement.

* Page 28.

**The Lug or Fisherman's Worm** (*Arenicola piscatorum*) is a favourite bait for a great variety of fishes, and is the only one that certain species will take. Although extremely common on all our sandy shores it is probably unknown to the majority of sea-side visitors, its habit of burrowing deep into the ground securing it alike from observation and danger. Traces of its locality, however, may always be found in the numerous little coils of fine sand, or worm-casts, with which a sandy beach is profusely covered. These are the results of the worm's peculiar manner of feeding, which consists of swallowing the sand or mud, and after appropriating any nutritious matter contained therein, the earthy substance is got rid of in the form of castings, just as in the case of the common garden earth-worm. The Lug-worm is about eight or ten inches in length, and has its breathing apparatus arranged in tufts along each side of the body. It is generally buried a foot or more in the ground.

The genus *Spirorbis* contains numerous minute species which construct for themselves spiral 'calcareous tubes, adherent by one side to seaweeds or stones. They are particularly abundant on the various species of *Fucus* whose ragged fronds are sometimes covered with these minute tubes. The worm is distinguished by the possession of six slightly pinnate gills or *branchiæ*, which form a beautiful object under a low magnifying power.

*Serpula triquetra.* This small species is extremely common on rocks and stones between tide-marks, and may be easily recognised by its three-sided tube, with a prominent tooth over the entrance. The gill-fans are subject to great variation in colour, but are usually of a mottled grey, sometimes of a reddish orange, and less frequently of a deep blue. It is a very hardy animal.

*Serpula contortuplicata* is the favoured occupant of every aquarium, and will live for a long time in captivity. It is, however, subject to frequent disfigurement from the gradual wearing away of the beautiful branchial plumes, and still more commonly from the loss of the operculum, with which the orifice of the tube is closed when the worm withdraws itself. If the projecting part of the worm be examined, two tentacula will be observed, one of them being very short and small, and the other long and expanded at the tip so as to act as a stopper. When this operculum is accidentally destroyed, a fresh one is developed from the small tentacle, and if this one also should be injured, then a new stopper is produced from the place where the original one stood. This power of reproducing lost parts depends of course on the healthy condition of the worm, and under favourable circumstances the renewal may take place three or four times, the fans being also capable of reparation, but generally requiring a long time for their complete reproduction. The tube of the *Serpula* is composed of lime secreted from the water, a membranous lappet situated near the head of the worm being the part immediately concerned in the work of construction; this lappet may be frequently seen overlying the edge of the tube, and on its removal a fresh deposit of lime will generally be observed. The movements of the *Serpula* in its tube are effected by a curious arrangement of spear-like bristles which are protruded through the feet on each side of the body, and, pushing against the walls of the tube, cause the gradual advance of the worm. The sudden backward movement is accomplished by means of hundreds of little toothed projections arranged in bands along a portion of the body; these little teeth are successively brought into contact with the lining of the tube, and by their rapid action the worm is enabled to withdraw in an instant. This species of *Serpula*

is commonly attached to oyster or scallop shells, and is rarely or never found within tide-marks.

*Sabella ventilabrum.*—*S. voluticornis.*—*S. vesiculosa.*—*S. reniformis.*—*S. bombyx.*—*S. tubularia.*—The species of *Sabella* are most obviously distinguished by the arrangement of their branchial plumes, and with the exception of *S. tubularia*, which constructs a slender calcareous dwelling, all our British species inhabit flexible tubes in which mud is incorporated with a dense membrane secreted by the worm. None of the *Sabellæ* possess an operculum or stopper for the tube. These beautiful worms are usually attached to old shells and live in moderately deep water.

*Amphitrite infundibulum.*—This is a remarkable worm inhabiting a membranous tube, which is commonly buried in the ground, from whose surface the branchial plumes rise in the shape of a funnel. The structure of these plumes differs from those in *Sabella* and *Serpula* in having a feathery fringe on the inner side of each stem, and reaching nearly to the centre of the funnel. The extremity of each plume is of a dark purple tint, and is slightly turned inward. The sudden appearance of this worm, a few years ago, in one of the centre tanks of the house, attracted much attention by its beauty and rarity, but it has since been found on several parts of the coast, and when young, is sometimes observed on old oyster shells. It is believed to be the species noticed by the late Prof. Edward Forbes in the Ægean Sea, but appears to have been known in this country for some time, and was described by Montagu nearly fifty years ago from specimens found by him on the Devonshire coast.

Among the numerous other worms which construct tubular dwellings we may mention *Terrebella conchilega*, one of a group well known for their habit of collecting small bits of shell and sand, for the purpose of uniting them by means of a silky secretion into a tube or covering for their delicate bodies. The above-mentioned species is found abundantly on sandy shores, but smaller kinds are common on oyster shells, and may be readily kept alive in the aquarium, where the operation of collecting grains of sand by the worm's long thread-like tentacles may be watched with facility.

Most of the true marine worms are furnished with tufts of spear-like bristles similar to those noticed in *Serpula;* they are protuded from fleshy appendages to the sides of the worm, and appear to perform the office of feet. The various forms of these organs in different kinds of worms are of considerable value as specific characters.

**The Skate-leech** (*Pontobdella muricata*) is found adhering to several kinds of Flatfish. It will live for a long time in confinement, but its general habit of remaining quietly curled up during the day, does not render it a very interesting captive.

*Hæmocharis piscium*, a true leech, is sometimes abundant in fresh-water tanks. The Pike appears to be particularly subject to its attacks, and unhealthy examples of this fish occasionally have as many as twenty of these parasites adhering to them at once.

*Nemertes Borlasii.*—This curious creature is wanting in many of the characters of the true worms, but may here be conveniently noticed. It is of enormous length, extremely elastic, and may be stretched to the extent of twenty-five or thirty yards. This strange and unsightly animal is not uncommon under stones on some parts of our coast, and is usually twisted and knotted together in the most confused manner. It possesses a long retractile proboscis, and feeds on various animal substances.

## IX.—ECHINODERMATA.

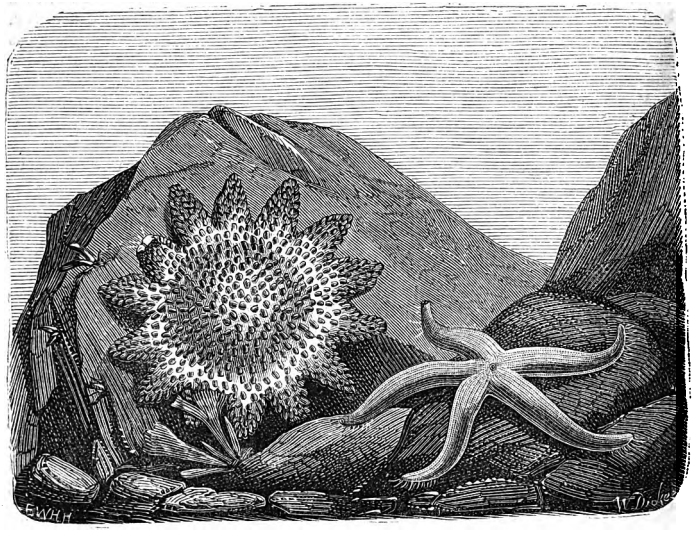
This class includes the Starfishes, Sea-Urchins, and Sea-Cucumbers, with a few other allied animals. Examples of these different groups are constantly exhibited in the Fish-house.

Among the starfishes, the **Rosy Feather-star** (*Comatula rosacea*) is one of the most beautiful, and whilst young is remarkable for being fixed on a long jointed stalk, thus representing at the present day, the elegant Crinoids or Stone-lilies whose fossil remains are so abundant in some parts of this country. The Feather-star is found on many parts of our coast, and is perhaps more numerous than is generally supposed. It adheres to rocks and seaweeds by means of a number of slender hooked filaments arising from the upper surface of the body, and also has the habit of swimming freely through the water.

**The Common Brittle-star** (*Ophiocoma rosula*). This is a very handsome species, brilliantly coloured, and very variable in its tints. Hundreds of them may often be obtained by one haul of the dredge.

**The Common Cross-fish** (*Uraster rubens*) is everywhere abundant, and may always be found among rocks near low-water mark. It is very voracious, feeding on various animal substances. **The Violet-Cross-fish** (*U. Violacea*) principally differs in colour from the common species.

**The Rosy Cribella** (*Cribella rosea*). This is rather a rare animal; it may be recognised by its slender rounded arms.



THE COMMON SUN-STAR. THE EYED CRIBELLA.

**The Eyed Cribella** (*C. Oculata*) has stouter arms than the preceding species, and is much more variable in its colouring, the general tint of the upper surface ranging in different specimens, from bright orange to a beautiful purple. It is usually found below tide-marks, and is very abundant in certain localities.

**The Common Sun-star** (*Solaster papposa*). The Sun-stars may be distinguished from all others by the number of their rays, which in this species varies from twelve to fifteen, instead of being restricted to the usual number, five. It feeds on shell-fish, and especially frequents oyster-beds.

**The Bird's-foot Starfish** (*Palimipes membranaceus*) is peculiar in having the intervals between the rays filled up with a flat leathery expansion of the body, giving the animal the appearance of the webbed foot of a bird. It is generally obtained in deep water, and is not very uncommon.

**The Gibbous Starlet** (*Asterina gibbosa*). This little Star is very abundant between tide-marks on rocky shores, particularly on our western coast. It will live for a long time in the aquarium without requiring much attention. This species has bred in the Fish-house, and the young are still alive, but have grown very slowly, probably from want of suitable food. **The Knotty Cushion-star** (*Goniaster equestris*) has also been kept alive for a long time. It is a rare species, of a brilliant scarlet colour, and resembles a small five-sided cushion.

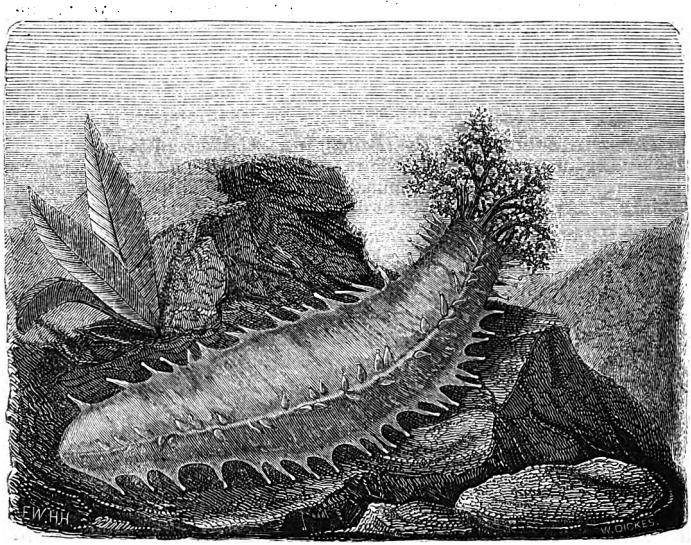
**The Purple Egg-urchin** (*Echinus miliaris*). This very common southern species thrives well in captivity, hiding itself among the stones of the tank, or crawling about nearly covered with bits of shingle which it attaches by means of its numerous suckers. In its natural state, this animal is generally found in dark hollows and crevices of rocks, often sheltering itself in some deserted hole bored by the Pholas. It lives on shell-fish and other animal food. Sea-urchins are closely allied to star-fishes, and the resemblance will be at once seen if the arms of an ordinary starfish are bent over until their tips meet at the mouth.

**The Great Sea-cucumber** (*Cucumaria frondosa*) is found in considerable numbers in the neighbourhood of the Shetland Islands, and the north coast of Britain. It is the largest of the European *Holothuriæ*, its body being capable of extension to a length of three feet, but its form is constantly changing by muscular contraction, which forces the water received at the mouth into the different parts of its body.

Ten large arborescent tentacula surround the mouth, and the body is furnished with five longitudinal rows of suckers by which the animal is enabled to move over the ground, or to fasten itself at will. It is not certainly known what these sea-cucumbers feed on; and this, combined with their large size renders them difficult to preserve in a moderate sized tank. Darkness is also a necessary condition of their existence. The Chinese markets are largely supplied with an article of food known as "Trepang," which consists of the dried bodies of a particular species of sea-cucumber.

**The Common Sea-cucumber** (*Cucumaria communis*) is not uncommon, but is rarely found so near the shore as the next species. It may be distinguished from it by the larger number of its suckers, as well as by its rough dirty yellow skin. In confinement it prefers a dark place, and generally hides under shelter of the rock-work. This species as well as the one next mentioned will take small bits of meat, seizing the food with its curious branched tentacles, and turning the tentacle with the meat far down into the throat.

**The Angular Sea-cucumber** (*Cucumaria pentacles*). This species is the commonest and most widely distributed of those found on our coasts; it may generally be discovered by searching carefully beneath



THE ANGULAR SEA-CUCUMBER.

projecting rocks, and in dark crevices close to low-water mark where it sometimes congregates in considerable numbers. It is very variable in colour, ranging from nearly pure white to dark purple or black, the same animal assuming many shades in the course of a few months. It is hardy, and will live many years in the aquarium, where the young are sometimes produced. **The Brown Sea-girkin** (*Ocnus brunneus*) is a small species about an inch in length with five rows of large elongated suckers on the body. It lives in much deeper water than the last mentioned species, and is rarely obtained excepting by the dredge.

**The Tailed Priapulus** (*Priapulus caudatus*). This very curious animal is unfortunately but rarely visible when in the aquarium, its habit being to bury itself among the stones, and to remain hidden for several months at a time. Its cylindrical body is furnished at one end with a large proboscis covered with minute tubercles, and capable of being rapidly protruded to some distance. The rough surface of this organ no doubt assists it in retaining its hold in the ground whilst in the act of burrowing. The most remarkable part of the Priapulus is the tail. This is composed of a number of little thread-like bodies, spirally arranged around a central stem, the whole organ being alternately distended and contracted, as the water received through the proboscis passes in successive waves or pulsations through the animal.

# MOLLUSCA.

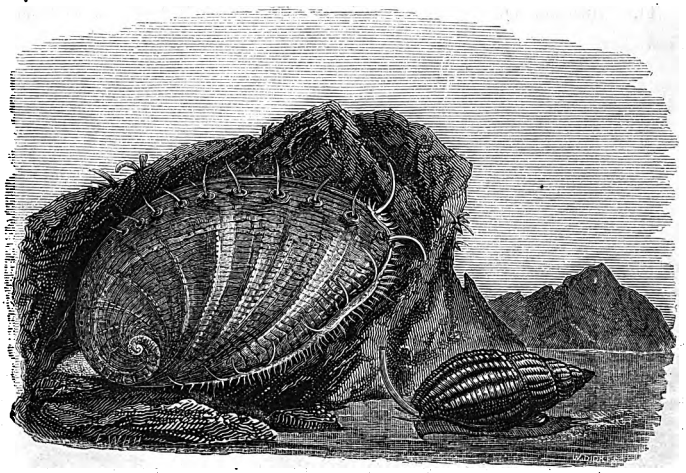
## X.—CEPHALOPODA, OR CUTTLE FISHES.

The Cephalopoda, the most highly organised group of the Mollusca, consist of those soft-bodied animals which have their feet or motive organs placed close to the head; with a few exceptions, they possess no external shell, but their bodies are strengthened by an internal support commonly known as the "pen" or "cuttle-bone." There are several species found in our seas, but they are difficult to keep alive in confinement, and their habit of discharging an inky fluid when disturbed renders them unpleasant occupants of the aquarium.

**The Sepiole** (*Sepiola Rondeletii*) has been occasionally exhibited. It is a small species, and abundant on many parts of our coast. When in the aquarium, it generally buries itself in the sand, with the head just above the surface, and its large eyes prominently displayed. It is, however, rarely seen to advantage after a long journey from the sea.

## XI.—GASTEROPODA, OR STOMACH-FOOTED MOLLUSCA.

**The Rock-Whelk** (*Murex erinaceus*). **The Dog-Whelk** (*Nassa reticulata*). **The Common Whelk** (*Buccinum undatum*). **The Purple** (*Purpura lapillus*). **The Spout-shell** (*Aporrhais pespelecani*). **The Tower-Shell** (*Turritella tenebra*). **The Periwinkle** (*Littorina littorea*). **The Livid Top** (*Trochus ziziphinus*). **The Ear-shell** (*Haliotis tuberculata*). **The Limpet** (*Patella vulgaris*).



THE ORMER, OR EAR-SHELL. THE DOG-WHELK.

These are all found within or near tide-marks, and, excepting the Ear-shell, are common species. The Ear-shell is but rarely seen on our shores; it is, however, very abundant around the Channel Islands during the summer months, and the writer has seen them in hundreds in the month of September at the small island of Herm, opposite Guernsey. It is about that time the "Ormers," as they are called, come near the shore, and are collected for the table, but they require a particular kind of cooking to render them tender and palatable. When the warm weather is past, these molluscs return to deep water. The specimens now exhibited were brought from Guernsey three or four years ago, and have since considerably increased in number, the young ones, at the present time, being nearly half-grown. The Ear-shell has much the habits of the common limpet, and is found adhering to the under surface of large stones close to low-water mark.

*Chiton fascicularis* is a curious little animal, in many respects resembling a limpet, but having the shell separated into eight scale-like plates. It is a hardy species, but rarely moves from its position in some dark corner of the tank.

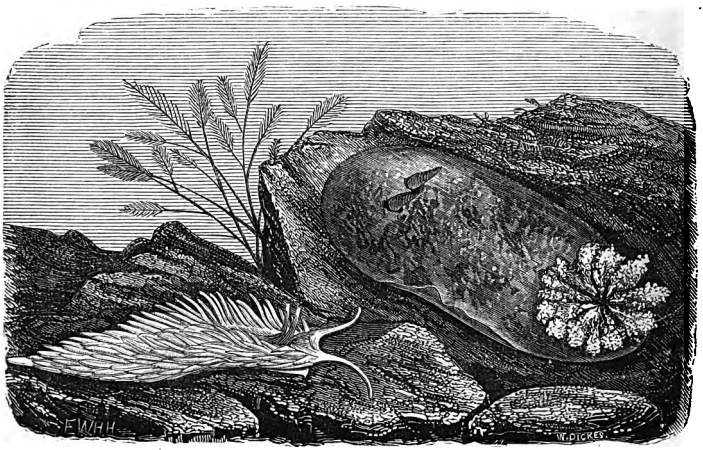
*Paludina vivipara*, *Limnæa stagnalis*, *L. peregra*, *Amphipeplea glutinosa*, *Physa fontinalis*, and *Planorbis corneus*, are all common fresh-water shells. The *Paludina* is remarkable for bringing forth its young alive.

**The Sea-Hare** (*Aplysia depilans*) is slug-like in appearance, but has a small shell placed on its back, and covered by the folds of the mantle. This animal feeds principally on seaweeds, and is common near low-water mark on most of our rocky shores.

---

## XII.—NUDIBRANCHIATA, OR NAKED-GILLED MOLLUSCA.

The animals belonging to this group are commonly known as




ÆOLIS PAPILLOSA. DORIS TUBERCULATA.

"Sea-slugs," and are distinguished by the possession of externa gills, remarkable for the variety both of their form and colouring.

**The Sea-Lemon** (*Doris tuberculata*).—*D. pilosa.*—*Polycera quadrilineata.*—*Eolis papillosa.*—*E. coronata.*

The Sea-Lemons have the gills or *branchiæ* in the form of a bunch of curled leaves placed on the lower part of the back. These animals are vegetable feeders, and deposit their spawn in long ribbons which may be frequently observed adhering in coils to the sides of the rocks near low-water mark.

The various species of *Eolis* are animal feeders, and frequently do a great deal of mischief in the aquarium by destroying the anemones. They deposit their spawn in spiral rings. Some of the species are found between tide-marks, but most of the nudibranchiate mollusca are inhabitants of comparatively deep water.

---

## XIII.—CONCHIFERA, OR BIVALVES.

This division includes the oysters, cockles, and other molluscs possessing double shells or valves. By the action of their gills, a stream of water is constantly being drawn into the body, and by this means respiration is carried on, and food is brought within reach of the mouth.

**The Common Oyster** (*Ostrea edulis*). **The American Oyster** (*O. Americana*). *Anomia Achæus.* **The Great Scallop** (*Pecten maximus*). **The Quin** (*P. opercularis*). **The Variable Scallop** (*P. varius.*)

These are all inhabitants of moderately deep water, the *Anomia* being generally attached to some larger shell. The scallops are well suited for the aquarium, and afford convenient objects for study, as the valves are usually widely separated, and the different organs of the animal displayed.

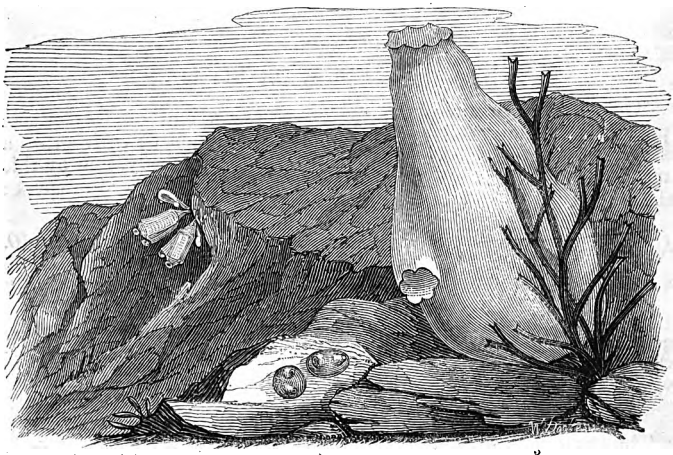
**The Sea-Mussel** (*Mytilus edulis*). *Dreissena polymorpha.* **The River Mussel** (*Unio litoralis*). **The Swan-Mussel** (*Anodon cygneus*). **The American Clam** (*Mercenaria violacea*). **The Gaper** (*Mya arenaria*).

The mussels fasten themselves to rocks or stones by means of the byssus, which consists of a number of silky threads produced from the foot. The process of spinning these threads may be readily watched in the aquarium. If a mussel be placed close to the glass front of the tank, a large finger-like organ—the foot, will soon be observed protruded from the gaping shell, and applied to the surface of the glass; a small slit near the tip of this foot is then opened, and the end of the thread attached, and on the foot being withdrawn the byssus will be seen leading from it to the glass. At first this thread is apparently soft, and hardens by contact with the water. The cockles and gapers live buried in the sand, receiving and expelling the water through membranous tubes or "syphons," and in the Gaper, these tubes are very large and cannot be withdrawn into the shell.

## XIV.—TUNICATA, OR ASCIDIANS.

The Tunicata, in many parts of their structure, resemble ordinary bivalves, but a tough leathery tunic here takes the place of the hard shell, and encloses each individual, as it were, in a sac. This envelope has two openings for the admission and exit of the water, and in many of the species the orifices are placed at the extremity of contractile tubes.

**The Sea Squirt** (*Ascidia mentula*).—*Cynthia rustica.*—*C. grossularia.* The last mentioned species is very common on oyster shells, but is sometimes found abundantly on rocks at extreme low-water mark. It is very small, and usually of a dull red colour. The other species adhere to sea-weeds below tide-marks.



1. 2. 3.

1. CLAVELINA LEPADIFORMIS. 3. ASCIDIA MENTULA.
2. CYNTHIA GLOSSULARIA.

*Clavelina lepadiformis* is a delicate transparent animal found adhering to rocks on many parts of our coast. It is a compound species, consisting of numerous individuals united by a creeping root. A fine group of these animals has been living for the last three or four years in one of the centre tanks in the Fish-house, and has afforded a rare opportunity for watching the periodical growth and disappearance of these curious organisms. The *Clavelina* will not bear exposure to much light, and, in a natural state, is only found in well sheltered situations.

*Perophora Listeri* is a very minute species, possessing many points of resemblance to the one last noticed.

*Botryllus polycyclus.* This is an essentially compound animal, being composed of numerous individuals grouped in circles, with one central

excretory orifice common to the members of each group. The circles are embedded in a jelly-like mass, which spreads like a plaister over the surface of rocks and the larger seaweeds.

---

## XV.—ZOOPHYTES.

The class of Zoophytes includes three distinct forms of polype, those of the Actinöid, Asteröid, and Hydröid orders.

The Actinöid polypes consist of the various kinds of Sea-Anemone, and those which secrete the ordinary white coral. Their general structure is very simple; they possess no definite system of nerves that can be certainly described, and, excepting in the case of touch, special organs of sense are wanting. Yet these animals are very sensitive to the influence of light, and many species will instantly close if the illumination be suddenly lessened. The sense of touch is more or less active over the whole surface of the body, and is especially marked in the tentacles. Digestive power is strongly exercised in all the species; the food passes through the short open tube leading from the mouth, and descends into the general cavity of the body, where it is dissolved, either entirely or in part, according to the requirements of the polype. That the solution of the food is due to ordinary chemical action, and not to simple pressure, is shown by the well known fact, that as soon as the food is swallowed the polype distends itself with water, and continues in this condition until the refuse of the meat is returned through the mouth, so that mechanical action is impossible, from the sides of the animal being widely separated. It has been stated elsewhere * that no true digestion takes place in these polypes, because food is often returned by them apparently unaltered in form and condition, but the mistake has arisen from the experiments having been made with too large pieces of meat, in fact, with much more than could be digested at once. The actual facts have been too often observed to leave any room for doubt on the matter.

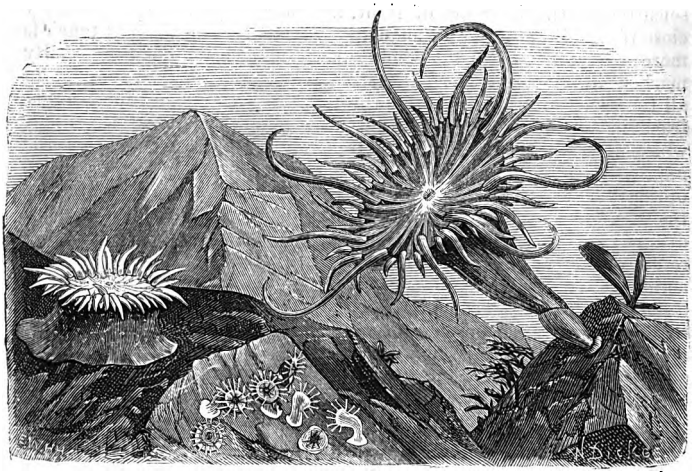
Most of the known polypes, if not all of them, have myriads of little cells containing an armed thread, disposed in various parts of their bodies, and especially numerous in the walls of the tentacles. It is by means of these thread-cells that the polypes are enabled to secure and disable their prey. The stinging effect of the projected threads is often instantaneous on many small animals, and is occasionally perceptible on the human skin. The structure of these stinging organs is minutely described in Mr. Gosse's elaborate work on the British Sea-Anemones.

* *Seaside Studies*, page 215.

## XVI.—SEA-ANEMONES.

**The Plumose Anemone** (*Actinoloba dianthus*) in its young state is found between tide-marks, but large specimens are generally procured only from deep water. It is tolerably hardy in confinement; full-grown examples, however, are too large for moderate sized tanks, unless a constant circulation of the water is maintained.

**The Daisy** (*Sagartia bellis*). This anemone is abundant all round our coast, particularly in rocky situations. It frequents the angles of rock-pools and other dark crevices, expanding its disk just above the surface of the ground. Its colours vary in different localities, and, as is the case with most of the anemones, the brightest tinted specimens are most numerous where the rocks are darkest, and the growth of sea-weeds most luxuriant and varied. Some of the specimens now exhibited have been in the tanks since the Fish-house was first opened in 1853.



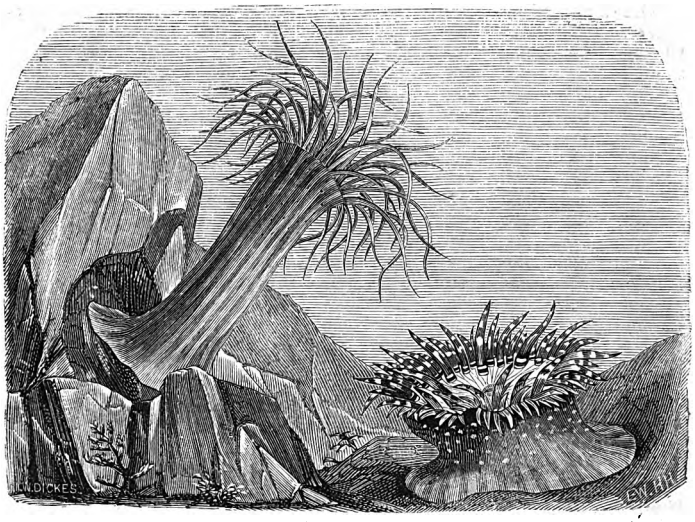
THE SNOWY ANEMONE. THE GLOBEHORN. THE TRUMPLET.

**The Scarlet-fringed Anemone** (*S. elegans*). **The Rosy Anemone** (*S. rosea*). **The Snowy Anemone** (*S. nivea*). **The Orange-disked Anemone** (*S. venusta*).

These are generally distributed along the southern coasts of Britain, and are all beautiful species, and hardy in confinement. They frequent crevices in the rocks, into which they can retire on the approach of danger, The Orange-disked Anemone was first found on the Devonshire coast by Mr. Gosse, who gave it the specific name of *miniata;* but the species agrees so perfectly with that previously met with on the Scottish shores by Sir John Dalyell, and by him named *elegans*, that the latter title has the first claim to adoption. The varieties of this species are endless.

**The Sandalled Anemone** (*S. sphyrodeta*). **The Eyed Anemone** (*S. coccinea*).

These are small and delicate species, not very abundant excepting on particular parts of our western coast. The Eyed Anemone was discovered very many years ago, but has been generally lost sight of until recently, when it was found abundantly in Torbay. It has only been obtained from deep water, and is commonly attached to the little spiral shell *Turritella tenebra*.



THE SNAKE-LOCKED ANEMONE. THE SCARLET-FRINGED ANEMONE.

**The Cave-dwelling Anemone** (*S. troglodytes*). **The Snake-locked Anemone** (*S. viduata*).

Both these species are well known in the aquarium, and are deservedly popular on account of their beauty and hardiness. They both love dark hiding places in the rocks, and are sometimes found buried in mud, and unattached by the basal disk.

**The Parasitic Anemone** (*S. parasitica*) is occasionally met with adhering to rocks, but its usual habit is to attach itself to a whelk-shell that is tenanted by the Hermit Crab (*Pagurus Bernhardus*). This anemone is very abundant along the coasts of the English Channel, and examples of it may always be seen in the Fish-house.

**The Cloak Anemone** (*Adamsia palliata*). We have noticed the habits of this curious animal in connection with Prideaux's Hermit Crab.* It is rather a difficult species to keep alive in the aquarium, and rarely survives for any time the death of its companion. Occasionally, however,

* Page 28.

it leaves the shell when the crab dies, and if it then becomes attached to the rock-work, there is a good chance of its living.

All the anemones now referred to are remarkable for emitting through their sides a number of slender white threads, which can be withdrawn at pleasure; these threads are, in reality, narrow ribbons with their edges rolled together so as to form a tube; they are filled with the dart-cells before noticed, and are employed as weapons of defence, winding round and adhering to any offending object within reach.

**The Trumplet** (*Aiptasia Couchii*) is rather a scarce species on our shores. It has been found in some numbers on the rocky coasts of the Channel Islands, and is probably identical with the species described by the late Professor Edward Forbes, under the name of *Actinia biserialis*. The original specimen that was placed in the Fish-house in 1857 has on two occasions divided itself *transversely;* in each case the separated portion has become a distinct and perfect animal, and a new adhesive disk has been formed on the original polype. This mode of reproduction is very unusual, and, as far as we know, has only occurred in this species.

*Anthea cereus*, sometimes known by the title of "Legs," is a southern species, exceedingly common on rocks near low water-mark. The two commonest varieties have the tentacles either green with rosy tips, or uniformly slate-coloured. It is very rarely seen in a contracted state, but it is a mistake to suppose that it has not the power of withdrawing the tentacles and entirely closing the disk. The *Anthea* frequently increases by splitting downward into two equal halves, which after a few days become perfect animals. Severe cold is at once fatal to this anemone.

**The Beaded Anemone** (*Actinia mesembryanthemum*). None of our sea-anemones are so universally abundant as this species. It is found on every part of our coast, excepting where the shore is entirely composed of sand or mud. Its numerous varieties also appear to be widely distributed. The large spotted variety, which sometimes grows to a large size, and somewhat differs in its proportions, has been considered a distinct species, and described under the name of *fragacea;* but it is connected with the typical *mesembryanthemum* by so many intermediate states of form and colouring that the specific identity of the two animals cannot well be doubted. The present species is extremely hardy. From its habit of frequenting situations not far from high-water mark, it is subject to a long exposure to the air, and will live for a considerable time under these circumstances, or in water whose natural conditions of purity, density, and temperature are materially altered. It breeds freely in the aquarium, and the young are generally brought forth alive.

**The Gemmeous Anemone** (*Bunodes gemmacea*). **The Glaucous Anemone** (*B. thallia*).

These two species are found only along our southern line of coast, and the Glaucous Anemone appears to be confined to the Bristol Channel. They frequent open situations, congregating in particular places suited to their habits, and as they will bear considerable exposure to light their beauties may be well seen in the aquarium by day as well as in the evening —the period when most of the anemones are best expanded.

**The Red-specked Anemone** (*B. Ballii*). Justice to Mr. W. P. Cocks, who first named this species, obliges us to reject the title of *clavata*, by which it has been known since its capture in 1851, by Mr. W. Thompson, at Weymouth. Mr. Cocks first met with the species in 1847, on the

coast of Cornwall, and it has since been found generally distributed along our southern and western shores. The tentacles of this anemone are usually curled inwards in a peculiar manner, and this arrangement gives a marked character to the animal. Sheltered situations are its favourite haunts.

**The Diadem Anemone** (*B. coronata*) is a scarce species, and hitherto has only been found in the neighbourhood of Torbay. It is usually attached to shells dredged in deep water, and derives its name from its appearance, when partly expanded, resembling that of a coronet. It is tolerably hardy in the aquarium.

**The Thick-horned Anemone** (*Tealia crassicornis*). This noble species is generally common, and often associated in large numbers. Between tide-marks it is met with in sheltered places, partly buried in sand at the foot of some rock, to which it also adheres. When in this position, and left by the tide, it easily escapes observation from its habit of covering itself with sand and bits of shell. Specimens from deep water are rarely thus coated; and when those found on the shore are placed in the aquarium, the artificial covering is soon thrown off. It is difficult to keep this species alive in a tank, unless there be a constant change of water, and if the animal has been injured whilst being detached from the rock, there is but little chance of its surviving, even when supplied with a stream.

A rare species named *Stomphia Churchiæ* is now exhibited for the first time in one of the side tanks. It has only been found in deep water off the Scottish coast.

*Peachia hastata.* This is one of the free anemones, never adhering by the base, but living buried in fine sand, with the tentacles spread out on the surface. It has only been found in Torbay, where, in 1855, the Rev. Charles Kingsley first discovered it. A specimen that has been nearly eighteen months in the writer's possession, shows, by its habit of always expanding at night, that dark situations are most suitable to it; and as it inhabits flat sandy ground, a considerable depth of water must be necessary to produce the required obscurity. We must, therefore, not expect to find it between tide-marks, and there is little probability of obtaining specimens unless they are washed on shore after the sea-bottom has been disturbed by heavy ground-swells. Three British species of the genus *Peachia* have been described by Mr. Gosse.

**The Vestlet** (*Cerianthus membranaceus*). Some doubt exists as to the propriety of referring our British species of this curious worm-like anemone to the one above named, which is found in the Mediterranean Sea. The external characters of the two animals are the same, but a difference in the arrangement of certain internal organs has induced Mr. Gosse to separate our native species under the name of *C. Lloydii*. This anemone lives in the ground, and encases itself in a tube formed entirely of dart-cells, whose threads interlace and produce a tough membranous covering into which the animal entirely withdraws when alarmed. Several fine specimens are now exhibited, their expanded disks showing just above the stones on the bottom of the tanks.

**The Sandy Creeplet** (*Zoanthus Couchii*) is a small species of compound anemone consisting of several individuals united at the base by a flat membrane, which extends in various directions, and, with the polypes, is attached to old shells or stones. The polypes and connecting band are densely coated with fine sand.

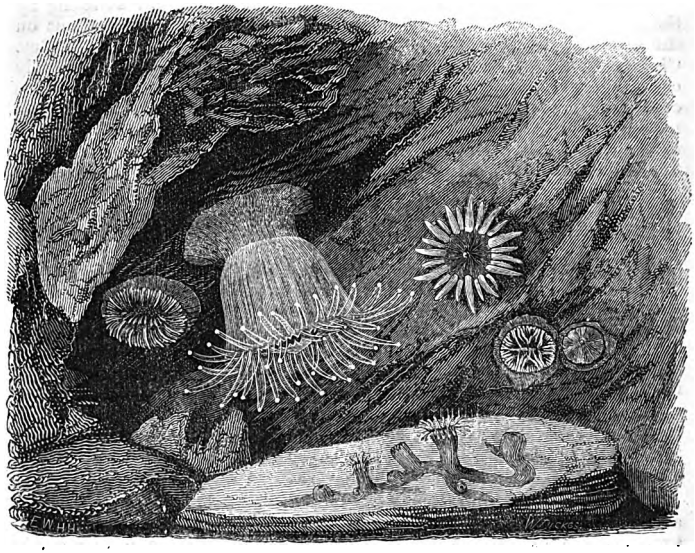
This species has been obtained with the dredge from deep water on several parts of our coast, but the *Zoanthi* are especially abundant in tropical seas, and are there found of various kinds, and growing to a considerable size.

**The Globehorn** (*Corynactis viridis*) is a delicate transparent little polype found associated in large numbers on the rocky parts of our coast. It is very variable in colour, and the tentacles and disk are usually of different tints from the other parts of the body. The shape of the animal is constantly changing, and the body very commonly assumes an hour-glass form. The tentacles each terminate in a globular head.

---

## XVII.—CORALS.

Corals are principally composed of lime secreted from the sea-water by polypes whose general structure is the same as in the anemones. Very few coral-polypes are found in the British seas. They especially abound in warm latitudes, where their labours result in the formation of dangerous reefs, extending many miles along a line of coast. From such localities the various well-known corals are brought to this country.




1. THE DEVONSHIRE CUP-CORAL. 2. THE ROYAL STAR-CORAL. 3. THE SANDY CREEPLET.

**The Common Cup-Coral** (*Caryophyllia Smithii*). This is the commonest of our native species, and is found on various parts of our coast, but is most abundant on the rocky portions of the southern and western shores. It frequents dark situations, and is usually attached to the under side of some projecting rock close to, or beyond low-water mark. When expanded, the delicate animal part of the coral in part, or entirely, clothes the calcareous portion, and projects beyond the margin of the cup to the distance of an inch or more. The tentacles are then widely displayed, and the whole animal appears like a transparent anemone. If, however, the polype should be alarmed, it immediately expels the water from the body and tentacles, and so completely retracts that nothing is visible but the stony skeleton or coral, although the hard parts are still covered with an almost imperceptible film of membrane. There is no difficulty in keeping this coral alive in the aquarium, but if it can be so placed as to hang down in its usual position, the polype will expand better, and show to greater advantage. It will not bear a great deal of light.

**The Royal Star-Coral** (*Balanophyllia regia*). The brilliant scarlet and gold of this species make it very attractive in the aquarium. It is very hardy, indeed almost impossible to kill. The species was discovered at Ilfracombe, in 1852, by Mr. Gosse, and, excepting on one occasion, in Plymouth Sound, it has only been met with at that locality. The stony plates in this coral are arranged in a peculiar manner, as may be seen in the accompanying woodcut, where the polype and skeleton of both the Cup-coral and Star-coral are figured.

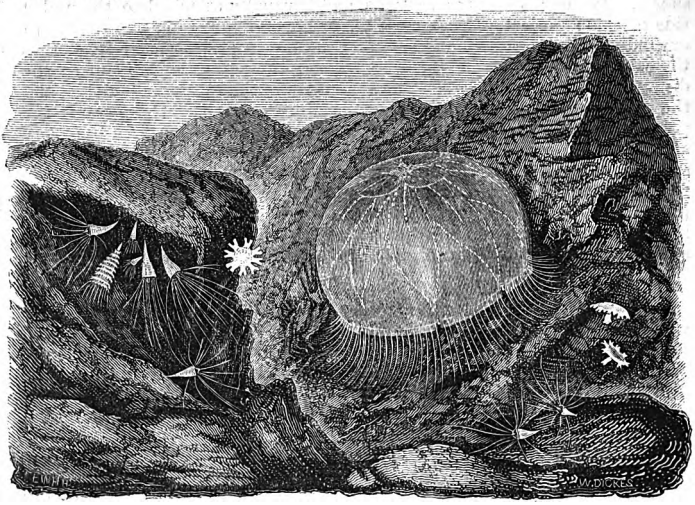
**The Dead Man's Fingers** (*Alcyonium digitata*). This curious zoophyte belongs to the Asteroid division of the polypes. It is generally in the form of a mass of fleshy fingers, each covered with a profusion of little polypes with eight fringed tentacles. It is very common in deep water, and small specimens are frequently found in rock-pools near low-water mark. The red coral, so much used for ornamental purposes, belongs to the same division of polypes as the above, but differs in having a stony axis or centre to the entire branching form of the compound animal. This stony portion constitutes the coral.

---

## XVIII.—MEDUSÆ.

**The Common Jelly-Fish** (*Aurelia aurita*). The form of this animal must be familiar to every one who has been by the seaside. It is very rarely seen in the adult state in any aquarium, but in the early stage of development it is very common and appears in almost every tank. Its mode of increase is very remarkable. The medusa produces ova which soon become developed into the little white polypes commonly known by the name of *Hydra tuba*. After a time, these polypes split across into a number of medusoids, having the general form of the original Jelly-Fish. As these little animals increase in size, their resemblance to the adult medusa is perfected, and in a few months after their appearance they attain their full size. Thus, the medusa produces a polype, and the polype a medusa, and the original form is not reproduced until the second generation. These changes have taken place on several occasions in the Fish-

house, but the young medusæ rarely attain the adult size in confinement. In 1859, however, the mild spring was favourable to their development, and some of the specimens in the aquarium grew to a considerable size.



THE COMMON JELLY-FISH.

Several kinds of minute zoophytes and polype-like animals occasionally appear in the several tanks in the Fish-house, but their forms can rarely be distinguished without a microscope, so that further reference to them is unnecessary.

# INDEX.

THE END.



LONDON: BRADBURY AND EVANS, PRINTERS, WHITEFRIARS.